EPTEMBER
1961

ICE 75 CENTS

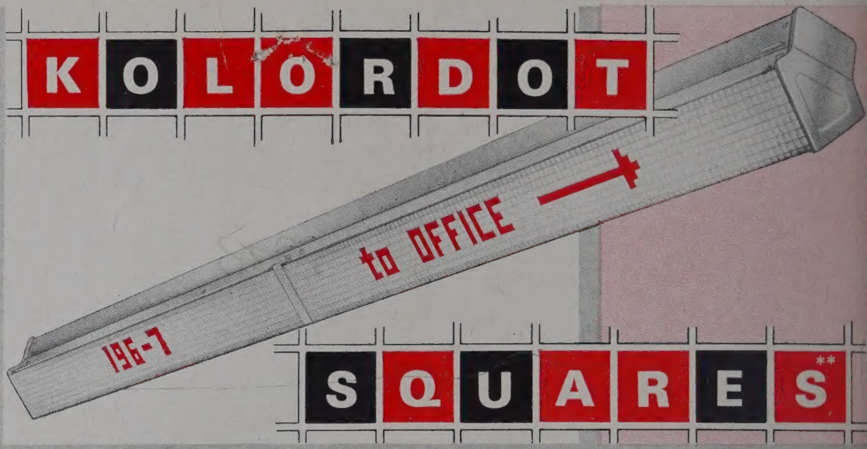
ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING

SEP 20 1961

A McGRAW-HILL PUBLICATION | 60TH YEAR

ACCENT the beauty of Gratelite with* GUTH *Kolordots*

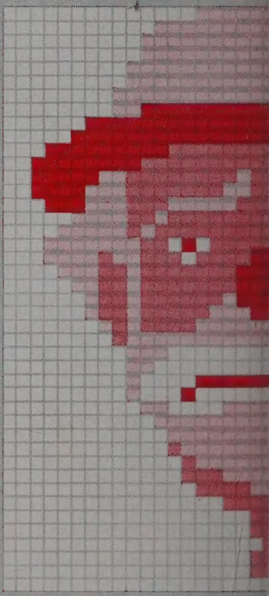


A new dimension of beauty in lighting. Functional and decorative!

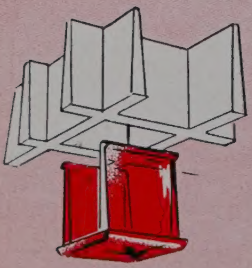
KOLORDOTS . . . versatile as the artist's brush. Just "snap, snap, snap" and you see words and designs or mosaic patterns come to life against the luminous glow of Gratelite . . . in ceilings or fixtures.

Four vivid colors — Sapphire Blue, Cardinal Red, Leaf Green and Vibrant Orange.

How can you use Kolordots? Just let your imagination go (and check the examples we show)!



KOLORDOTS *snap-lock into the ⅜" Gratelite cubes*



in four vivid colors

Point out departments, designate areas or rooms, or just "play Picasso!" KOLORDOT SQUARES will add new sparkle and beauty to your Gratelite ceiling or fixture.

Guth
LIGHTING since 1902

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CAN. PAT. NO. 538,245
**® T. M. REG. AND PATS. PEND.

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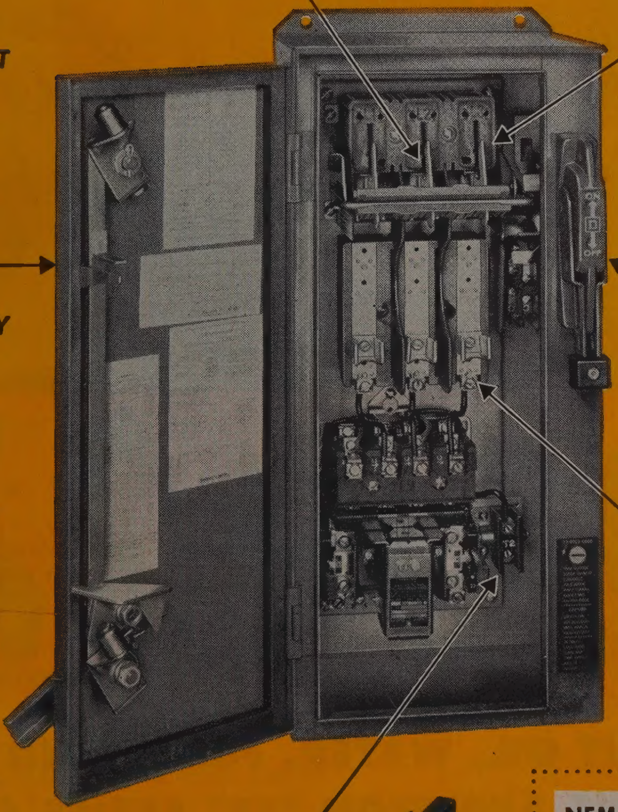
WRITE FOR FULL-COLOR BROCHURE

All these Square D features make this

THE SAFEST, MOST RELIABLE COMBINATION STARTER

VISIBLE BLADES You can see the switch is open and know you're safe!



ELECTRICAL INTERLOCK ON SWITCH

Optional single or double-pole interlock available to disconnect separate control circuit power. Assures complete safety!

REALLY DUST-TIGHT

NEMA 5-12 construction keeps out dust and coolant. Positive door-closing mechanism assures complete seal before switch can be operated.

DOOR CLOSES SIMPLY and EASILY

No cover bolts to secure — just push door shut and turn door handle to close and seal.

FOOL-PROOF OPERATING MECHANISM

Handle is permanently attached to switch to eliminate hazard of false handle indication. With door open, the switch can not be operated accidentally.

EASY TO INSTALL

Through wiring with no interference from disconnect switch. Line terminals are at top, load terminals at bottom. Starters can be ganged with less than ½ inch between them.

CONVERTIBLE FUSE CLIPS

If horsepower or voltage requirements change, modification kits provide easy change of fuse clip size and spacing.

WIDE RANGE OF SIZES

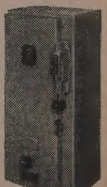
New Square D combination starter now available in NEMA Sizes 0 through 4.

3rd OVERLOAD RELAY

Space to add an additional overload relay when desired.

NEMA TYPE 1 ENCLOSURE ALSO AVAILABLE

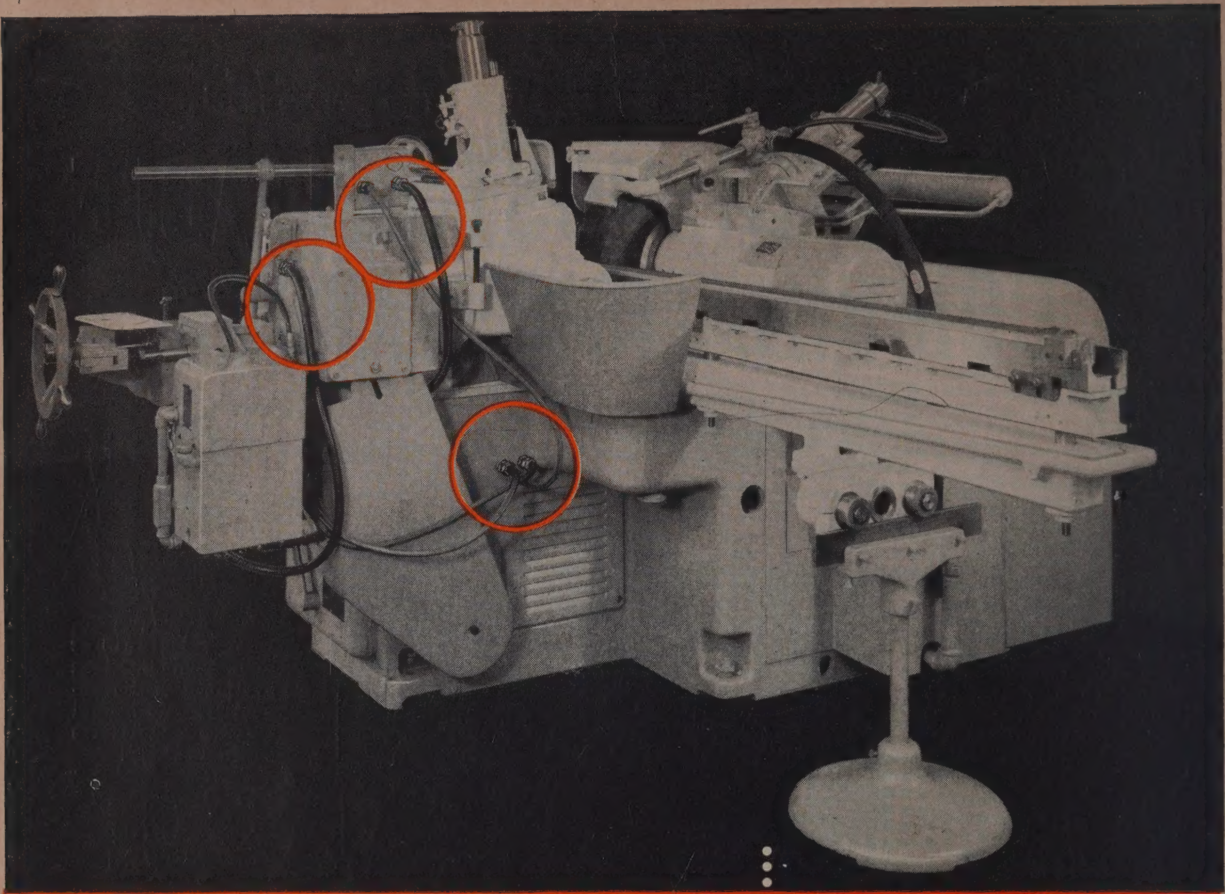
NEMA Type 1 enclosures, offered in Sizes 0 through 4, can be modified by addition of a pushbutton, selector switch or other accessories. Easy-to-use kits simplify field installation.

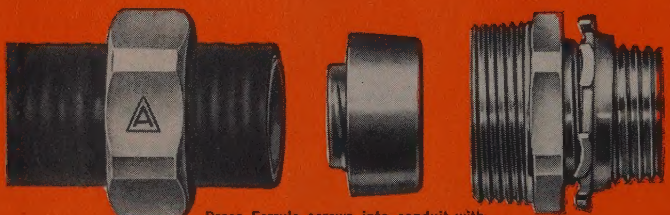


Write for Bulletin SM-292. Address Square D Company, Dept. SA, 4041 North Richards Street, Milwaukee 12, Wis.

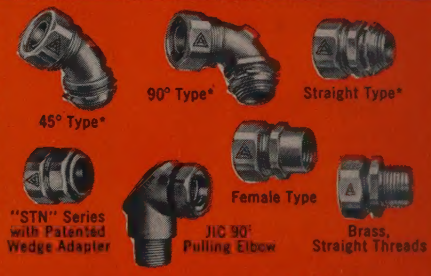
SQUARE D COMPANY

wherever electricity is distributed and controlled





Brass Ferrule screws into conduit with outer sleeve covering conduit. Tightening compression nut swages ferrule onto conduit providing a positive seal and permanent round.



*Available with or without insulated throat.

SEAL OUT OIL, WATER, FUMES AND DUST WITH EXCLUSIVE APPLETON "ST" SERIES CONNECTORS

Liquid-tight conduit is only as liquid-tight as the connectors used, only as good a ground as the connectors provide.

APPLETON "ST" Series Connectors have been recommended for years because their patented, exclusive construction is simple and rugged — the hallmark of true engineering design. There are only three all metal parts. Nothing to loosen, deteriorate, crack or break. "ST" connectors positively prevent foreign matter from entering wiring systems and at the same time, provide a permanent ground between connector and conduit

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ELECTRICAL CONSTRUCTION AND MAINTENANCE

with which is consolidated Electrical Contracting, The Electragist and Electrical Record . . . Established 1901

Published for electrical contractors, electrical departments in industry, engineers consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management in the field of electrical construction and maintenance.

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By H. STEAD—High-output fluorescent lamps, with cycling controlled by photocells and astronomic clock auxiliaries, are installed in highway tunnel to produce 50 footcandles of portal intensity.

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MORE

SILICONE NEWS from Dow Corning

Blueprint for Reliability

For Performance Plus...Specify Silicone Insulated Transformers

Here's Why—(1) *Low cost installation* . . . transformers using silicone insulation systems are up to 50% lighter, 50% smaller and require no costly vaults or barriers. (2) *Lower operating costs* . . . silicone insulated transformers are virtually maintenance-free — have no liquids to filter or change — need no space heaters to keep de-energized windings dry. (3) *Maximum safety* . . . silicone insulated transformers are completely dry. There's no danger of toxic fumes, or fire. (4) *Maximum reliability* . . . silicone insulated transformers operating at 200 C have a longer life expectancy than Class A transformers operating at 100 C. Depending on design, silicone insulated transformers withstand overloads of 25 to 50% above rated capacity. Units have been flooded without damage to windings.

Here's How — Dow Corning silicone insulation has excellent electric strength and is unaffected by thermal cycling and high temperature . . . enables transformer manufacturers to (1) produce lighter, more compact units — units that double capacity without increasing space or weight requirements; or (2) build units that withstand substantial overloads.

Here's What — Silicone insulated dry-type transformers in three enclosures: (1) open, (2) enclosed and (3) gas-filled sealed.

Here's Where — For load center substations, a choice of enclosed, open or sealed gas-filled dry-type transformers that require no costly vaults—can be located on roofs or balconies to conserve valuable floor space.

Here's When — Right now! Whether you are planning for future growth, expanding present facilities or replacing old equipment, consider the possibility of using silicone insulated transformers. Initial price is competitive, and, when you consider their lasting values, silicone insulated transformers give you more for your money . . . a whole lot more!

Write today for 8 page brochure entitled "Specify Silicone Insulated Motors and Transformers and Save!"

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Silicone Insulated Transformers.
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ELECTRICAL CONSTRUCTION AND MAINTENANCE

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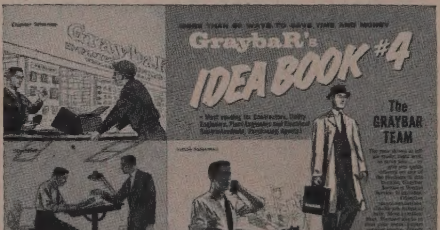

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GraybaR's IDEA BOOK #4

The GRAYBAR TEAM

Fast, Temporary Conversion to 3-Wire GROUNDING SAFETY

NATIONAL ELECTRIC SURFACE WIRING SYSTEMS

New High Voltage Requirements Spur Residential Usage of TRIANGLE EMT

640

Sidelights

PLAN FOR GOOD TIMES

Signs of increased activity across the board in consumer spending, capital investments and government outlays giving new acceleration to the economy and creating a climate for what is expected to be a period of record growth for the electrical industry in the months ahead. This optimistic outlook is drawn by Associate Editor Berlon C. Cooper in our annual statistical summary. His report "Record Electrical Growth in 1962" leads off our editorial feature section this month beginning on page 85.

SUBSTATION MAINTENANCE

Outdoor substations on plant grounds and under the supervision of plant personnel are usually so ruggedly designed and built as to require infrequent attention. But their importance to the electrical system is so vital they cannot be neglected. Fortunately, most of the troubles that can crop up are readily preventable by systematic inspection and maintenance. Assistant Editor Robert J. Lawrie details a practical plan of step-by-step inspection and maintenance procedures for a typical industrial substation installation in "How to Plan Outdoor Substation Maintenance" beginning on page 100.

TUNNEL LIGHTING

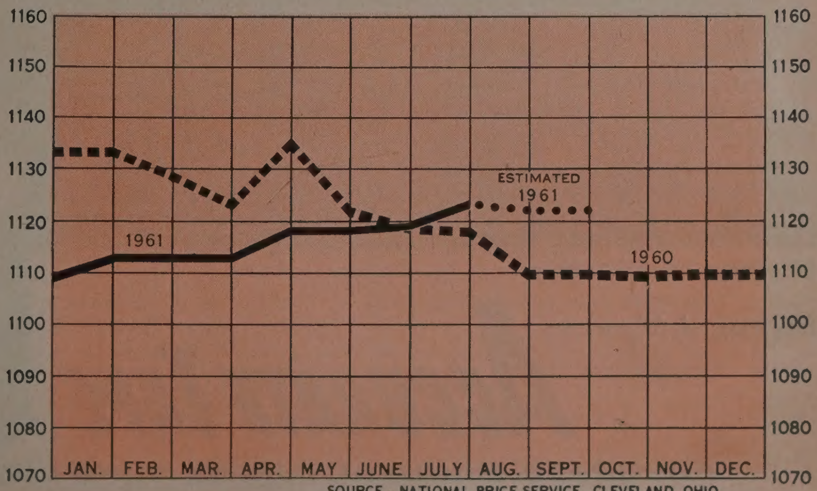
Safety in tunnels is critically dependent on the lighting design, particularly near the portals where drivers' eyes must adjust from intense daylight to the relatively lower levels of tunnel illumination. A case study in the problem and its practical solution is provided by recently-completed Mule Pass in Cochise County, Arizona, described by H. Stead, Traffic Supervisor, Arizona Highway Dept., in "Tunnel Lighting with H. O. Lamps" beginning on page 104.

REMOTE METERING

In providing for central individual apartment or office metering in a multiple occupancy building, it is usually necessary to run individual feeders to each tenant thus sacrificing the diversity advantages that could be achieved with common feeders. A new system of remote energy metering promises to permit the full advantage of common feeder design. A specially designed and compensated current transformer in the tenant panel wired to the central meter bank does the trick. The system is described by Associate Editor J. F. McPartland in "Remote Metering System" beginning on page 116.

ELECTRICAL MATERIALS COST INDEX

BASE LINE (1000) REPRESENTS COSTS OF TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. INDEX POINTS REPRESENT THE VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.



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ACCURATE TAPE

ACCURATE MANUFACTURING COMPANY
Garfield, New Jersey

Washington Report

SEPTEMBER • 1961

The nation's economy is climbing to new records at a spectacular pace. Current estimates of gross national product for the fourth quarter are $540 billion (seasonally adjusted annual rate), and perhaps as high as $560 billion for the first quarter of 1962. GNP for first quarter of 1961 was approximately $500 billion. Included in GNP statistics, however, is government spending—Federal, State, local—which is also spiraling upwards. This helps to confuse the picture of the true status of the economy, but most segments are also showing new strength and setting new records. Consider the following important indicators, for example:

- **Industrial output** in July climbed to a record high of 112% (FRB Index), exceeding the previous record of 111% for January 1960.
- **Construction spending** in July hit a record annual rate of $57.8 billion, up 2% from June rate, and up 5% from July 1960 rate.
- **Personal income** set a new record in July—a seasonally-adjusted annual rate of $421.8 billion.
- **Electric power production** set new weekly records in July and August, with latest record totaling 16.14 billion kwhr for week ending August 5.

National debt set a record of $293.1 billion during the last week in July, highest for any date in the nation's history. Congress only recently raised the legal national debt ceiling to $298 billion, and the new defense speedup which is officially expected to swell the Federal budget deficit to $5.3 billion in fiscal 1962 could push the national debt close to the new ceiling during the coming winter months.

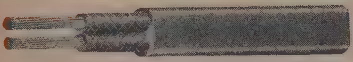
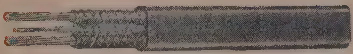
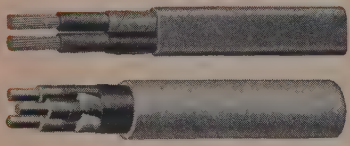
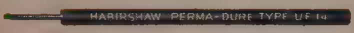
Federal spending increases and budget deficits now in the making are giving rise to inflation worries, both in government and out. Spending this year (fiscal 1962, ending June 30, 1962) is rising rapidly. President Kennedy has requested new spending authority of more than $15 billion during his first six months in office, of which only $5.7 billion, or 37%, is for defense purposes. The Administration contends that stepped-up business activity could push Federal revenues up as much as $10 billion in fiscal 1963, based on current tax rates, help meet the increased spending plans, and keep inflation under control. Even so, anti-inflation moves, including a possible clamp down on credit by Federal Reserve System, and standby wage and inventory curbs are being considered and prepared.

New construction spending totaled $5,433 million in July, up 1% from June, and 5% from July 1960, Commerce Dept. reported. Expenditures for private construction totaled $3.7 billion, while public construction spending totaled $1.7 billion. Public construction outlays were up 4% from June, and 8% from July 1960.

More than $818 million in Federal highway funds, comprising the allocation to states for the last quarter of this year, were released in August by Commerce Dept., on Presidential order, to further aid the economy through accelerated spending.

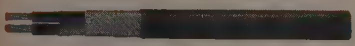
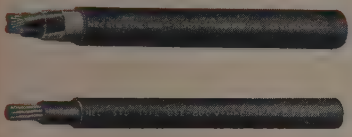
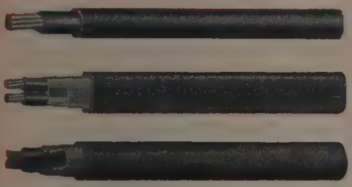
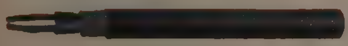
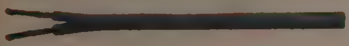
Congress approved a $207 million appropriation for a stepped-up civil defense program, which President Kennedy had asked for as part of the $46.7 billion bill for defense. Focal point of the civil defense program is almost sure to be fallout shelters, for both homes and public buildings.

Index of Phelps Dodge

Wires and Cables	Type Letter	Trade Name or Designation	Maximum Operating Temperature	USE
	ACV	Armo-Lok	85 C (185 F)	Dry Locations
	None	Armo-Lok	85 C (185 F) High Voltage	General Purpose: Consult manufacturer for specific applications
	**W**	Portable Power Cable	75 C (167 F)	Mining Machines, Dredges, Shovels, and similar portable applications Pennsylvania Dept. of Mines Flame Resistance Approval P-114. U. S. Bureau of Mines Listing P-114-BM.
	**G**		Low Voltage	
	SHD		85 C (185 F) High Voltage	
	RHW	Flamestop Heat and Moisture Resistant	75 C (167 F)	Dry and Wet Locations
	RHH	Flamestop Heat-Resistant	90 C (194 F)	Dry Locations
	**RHL**	Heat Resistant Rubber Lead	75 C (167 F)	Wet Locations and other Special Conditions
	NM	PD-X Fibrous-covered, Non-metallic-Sheathed Cable	60 C (140 F)	For Wiring Houses, Rural Buildings, Small Stores, and Shops.
		PD-XT Thermo-plastic-covered, Nonmetallic-Sheathed Cable	60 C (140 F)	For Wiring Houses, Rural Buildings, Small Stores and Shops
	**UF**	Perma-Dure Nonmetallic-Sheathed Cable	60 C (140 F)	UF: Underground Feeder and Branch Circuit Cable for Direct Burial.
	UF-NMC			NMC: For Interior Wiring in Moist or Corrosive Locations.
	THW	Habirdure Thermo-plastic insulated	75 C (167 F)	Dry and Wet Locations
	TW		60 C (140 F)	Dry and Wet Locations
	TF		60 C (140 F)	Fixture Wire
	TW	Petro-Dure Thermo-plastic Insulated Nylon Jacketed	60 C (140 F) 30 C (86 F)	Dry and wet locations and where exposed to mineral oil Where exposed to liquid gasoline and gasoline vapor.

PHELPS DODGE COPPER PRODUCTS CORPORATION

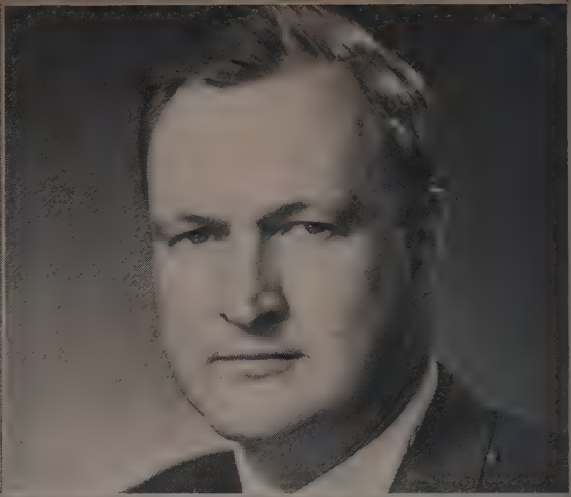
Wires and Cables

Wires and Cables	Type Letter	Trade Name or Designation	Maximum Operating Temperature	USE
	TW	Habirdure (9T)	60 C as TW 90 C as Appliance Wiring	NEC Type TW Bldg. Wire—60°C Appliance Wiring—90°C in air or 60°C in water or oil
	None	Habirdure Appliance Wire	105 C (221 F) IN AIR 80 C (176 F) IN OIL	Appliance Wiring
	SE	Service Entrance Type SE — Style U Unarmored	75 C (167 F)	Service Entrance or Combination Service Drop & Service Entrance
	**SD**	Service Drop Type SD	60 C (140 F)	Service Drop
	**USE**	Service Entrance Type USE	75 C (167 F)	Underground Service Entrance, Direct Burial.
	V	Varnished Cloth Braided	85 C (185 F)	Dry locations only. Smaller than No. 6 by special permission.
	VL	Varnished Cloth Lead	85 C (185 F)	Wet or Dry locations. Smaller than No. 6 by special permission.
	**None**	Habirduct Habirprene	75 C (167 F) Low Voltage	General Purpose for Direct Burial, Aerial, Conduit and Underground Duct Installations.
		Habirite Habirprene	85 C (185 F) High Voltage	
	S or SO	Hard Service Cord	60 C (140 F)	Pendant or portable extra hard usage in damp locations; SO for oil resistance
	**SJ or SJO**	Junior Hard Service Cord	60 C (140 F)	Pendant or portable hard usage in damp locations; SJO for oil resistance
	**SP**	All Rubber Parallel Cord	60 C (140 F)	For use in pendant or portable applications in damp locations not subject to hard usage

BUILDING WIRES AND CABLES

"Concealed telephone wiring? I find it a valuable sales aid—especially with second-time buyers"

SAYS JACKSON F. BLACKMAN,
BUILDER OF "BRINTON LEA" HOMES
NEAR MEDIA, PA.



"The home buyer is becoming more discriminating all the time," says Jack Blackman, award-winning builder of Media, Pa. "I must plan for as many conveniences as possible in my homes. And one of the most important of these is telephone planning. Prospects recognize its advantages. My salesmen know how promotable it is."

Mr. Blackman is building more than 100 homes in "Brinton Lea." He installs concealed telephone wiring outlets in each home, including one over the front door to accommodate the door answering unit of the Bell System's new Home Interphone. He also puts outlets in garages and laundry rooms, thus providing for every possible telephone location, present and future.

"Most of my customers are second-time buyers who know what they want in a home," Mr. Blackman adds. "That's why I call in telephone company representatives on *all* my jobs. Pre-planning allows me to place concealed telephone wiring where it's best for the customer—and best for our carpenters."

* * * *

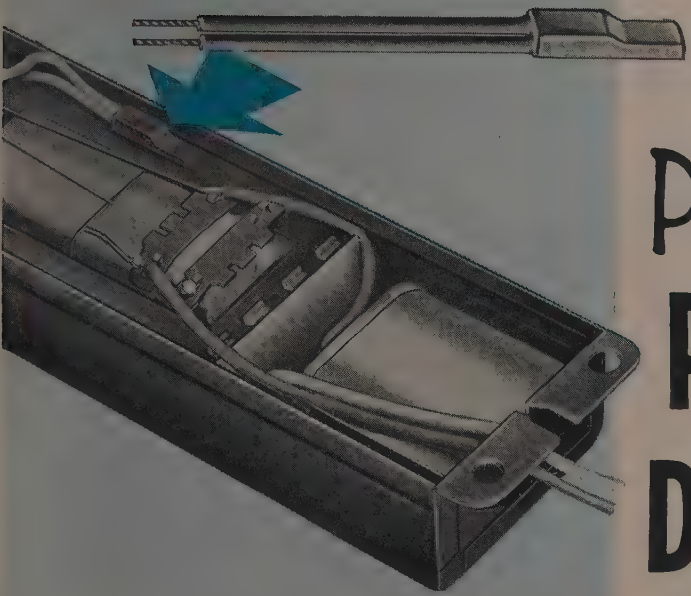
Your local Telephone Business Office will gladly help telephone-plan your homes. For details on home telephone installations, see Sweet's Light Construction File, 11c/Be. For commercial installations, Sweet's Architectural File, 34a/Be.

BELL TELEPHONE SYSTEM

The **Country Squire** model at "Brinton Lea" near Media, Pa.—featured in American Home as "Best home for the money in Pennsylvania." House and grounds: $27,000.

Only ADVAN guard®

AUTOMATIC RE-SETTING THERMOSTAT



Protects against PREMATURE DESTRUCTION

OF FLUORESCENT LAMP BALLASTS . . . AND ELIMINATES THE NEED FOR INDIVIDUAL FUSING.

ADVAN-guard® protects fluorescent lamp ballasts against premature destruction and costly replacement by protecting against abnormal operating temperatures due to incorrect voltage supply, excessive current, lamp rectification, internal ballast short circuiting, inadequate lamp maintenance and improper fixture application.

ADVAN-guard®, a thermally actuated protective thermostat sealed in the ballast housing, automatically 'trips-out' whenever the ballast operates at abnormal temperatures from any internal or external cause. Unlike other protective devices which permit premature ballast destruction by cutting the ballast out of the line only after it has been destroyed, ADVAN-guard® cuts out before heat can cause premature destruction, resets automatically when the trouble has been corrected and permits the ballast to resume normal operation.

Don't settle for one-time protectors that destroy fluorescent lamp ballasts after a single cycle of abnormal temperatures . . . insist on ADVAN-guard® equipped fluorescent lamp ballasts for safety and longer life.

"The Heart of the Lighting Industry"®

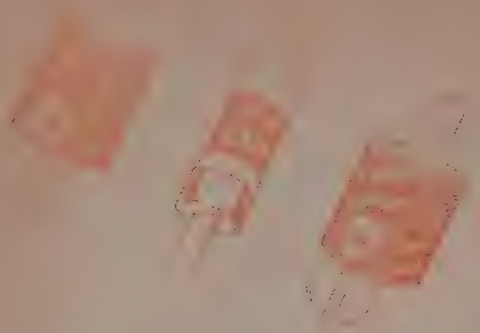
Mfg. in Canada by: Advance Transformer Co. Ltd., 5780 Pare St., Montreal, Quebec

ADVANCE® TRANSFORMER CO.

CBM CERTIFIED by E.T.L.

WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF FLUORESCENT LAMP BALLASTS

2950 NO. WESTERN AVE. CHICAGO 18, ILL. U.S.A.



Electrical Protection goes MODERN with BUSS Fuses...

in All-Electric Schools

Utica Michigan

● *Electricity* heats, lights, pumps water, cooks and operates all motor driven equipment in the West Utica and the Ewell Elementary Schools. No other utility service is used except the telephone.

The complete use of electrical energy puts special emphasis on the need to use the safest, most modern protective devices throughout the electrical system.

In each school, the main switchboard is protected by 3—1600 ampere BUSS Hi-Cap fuses having an interrupting rating of 200,000 amps. rms symmetrical. Thus, safe interruption of fault currents now available is assured,—and the fuses are adequately safe to allow for future system growth.

If a high fault current should occur, the fast opening characteristics of BUSS Hi-Cap fuses further protect the circuits and equipment against damage by restricting let-thru fault currents to safe value.

Feeder and branch circuit protection

To provide the safest short-circuit and overload protection . . . and to prevent needless outages,—FUSETRON dual-element fuses are used in the feeders and branch circuits of these schools.

For modern, all-purpose protection of circuits up to 600 amps., FUSETRON fuses cannot be equalled. They have 100,000 amp. interrupting capacity,—and sufficient time-lag to hold harmless overloads.

For more information on

FUSETRON dual-element fuses
. . . write for bulletin FIS

BUSS Hi-Cap fuses
. . . write for bulletin HCS

BUSSMANN MFG. DIVISION, ***McGraw-Edison Co.*** **St. Louis 7, Mo.**

Switchboards protected by BUSS Hi-Cap and FUSETRON dual-element fuses.

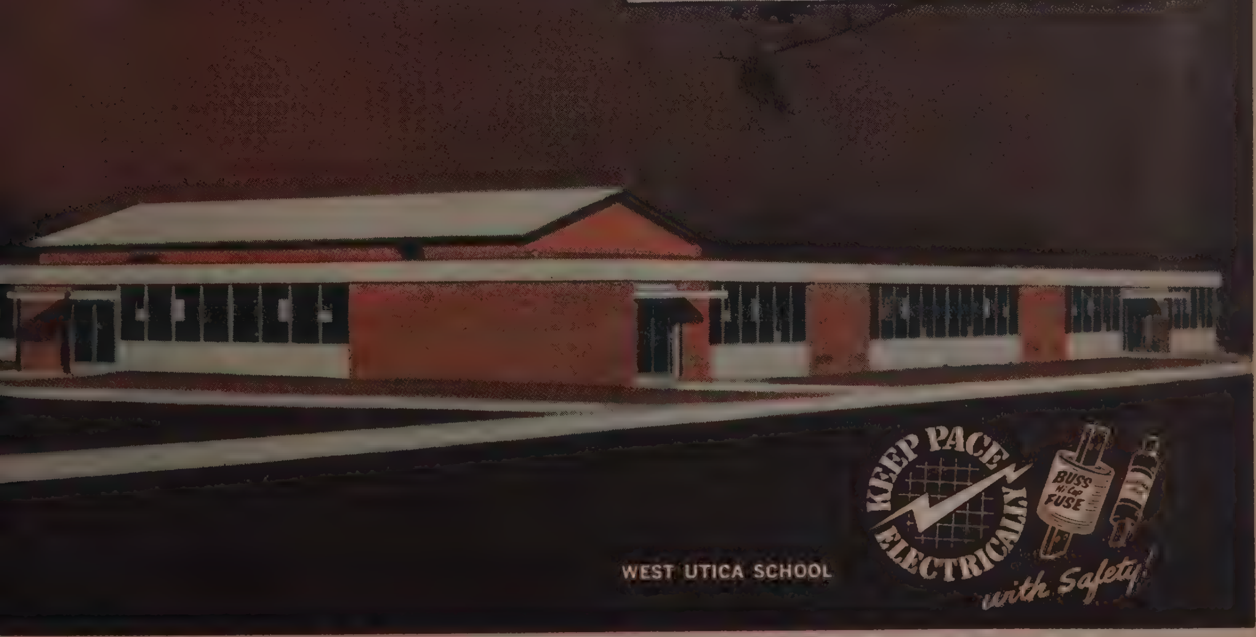
Architects—
SMITH & SMITH / ASSOCIATES
Royal Oak, Michigan

Consulting Engineers—
B. A. KING & ASSOCIATES, INC.
Birmingham, Michigan

Electrical Contractors—
SCHEPER'S ELECTRIC CO.
Utica, Michigan

General Contractors—
Ewell Elementary School
GILBERT & KERNER
Utica, Michigan

West Utica School
CHISSUS CONSTRUCTION CO.
Birmingham, Michigan



INCREASE YOUR CURRENT

USS

American Steel and Wire
Division of
United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad

CARRYING CAPACITY 45%

. . . with USS Amerzone-B insulation*

Amerzone-B butyl rubber insulation can be safely operated continuously at 90°C copper temperature. This means you get a 45% increase in current-carrying capacity with Amerzone-B as compared to the capacity of standard 60°C rated compounds. For network service, Amerzone-B will withstand emergency overload copper temperatures *up to 260°* for short periods without damage. No other rubber insulation has such exceptional resistance to heat, moisture, ozone and cold. You can bend it at —40°F. without cracking. Ozone tests to industry standards show no damage to this dense, nonporous insulation. Amerzone-B insulated cables installed over 12 years ago are just as good today as they were when installed. It's the ideal insulation for 5,000 to 15,000-volt cable. You can use USS Tiger Brand type RR Cable with Amerzone-B insulation anywhere . . . bury it, put it in conduits or ducts, string it overhead.

USS Tiger Brand type RR Cables are also made with other types of rubber insulation, each one compounded to do a special job. For complete information on Amerzone-B insulated cables or any other Tiger Brand Cable, call our nearest Sales Office or write American Steel and Wire, Dept. 1241, Rockefeller Building, Cleveland 13, Ohio.

USS, Tiger Brand and Amerzone-B are registered trademarks

*Conditions: 3 single conductors # 4/0 in 2½" conduit (exposed & enclosed), 40°C ambient air temperature

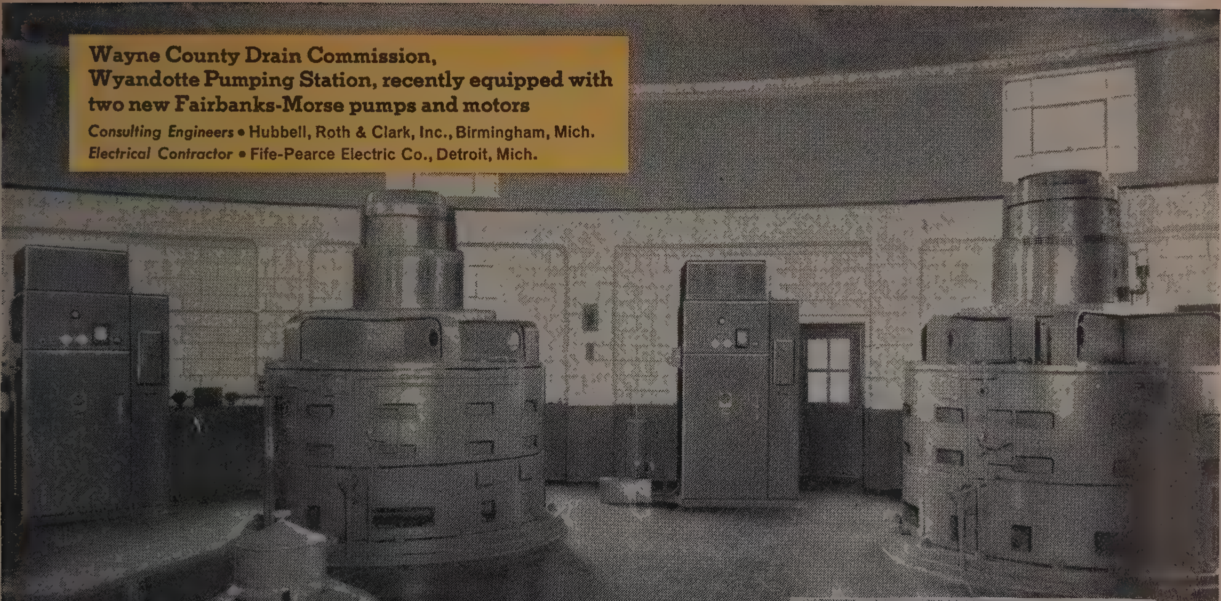
Twenty Years Proof of savings, safety and reliability comes when you specify insulation based upon Geon vinyl compounds. Manufacturer after manufacturer knows it—that's why so many choose Geon vinyl again and again. There's another advantage, too: Using Geon compounds assures uniform high quality, since B.F.Goodrich Chemical has built its reputation through such dependability for two decades.

Geon compounds make insulation *really* weatherproof. No question about moisture resistance. No problems of aging, or exposure to oil or grease. And the best part is that you get superior performance at no extra cost to you.

There need be no confusion on quality—just specify Geon vinyl. Your supplier can provide performance data, or you can write Department NQ-6, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. In Canada: Kitchener, Ontario.

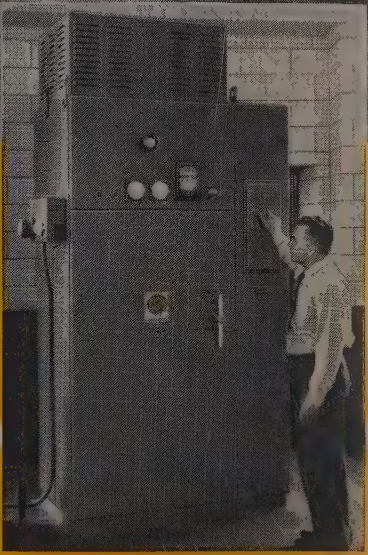
B.F.Goodrich Chemical
a division of The B.F.Goodrich Company

Geon
VINYLS



Wayne County Drain Commission, Wyandotte Pumping Station, recently equipped with two new Fairbanks-Morse pumps and motors

Consulting Engineers • Hubbell, Roth & Clark, Inc., Birmingham, Mich.
Electrical Contractor • Fife-Pearce Electric Co., Detroit, Mich.



Certificate on File in Cleveland

Certified Fault Protection WITHOUT FUSES!

EC&M Fuseless Starters

ELIMINATE FUSE PROBLEMS & COSTS

Now you can get full fault protection without the problems associated with fuses. EC&M's fuseless starters have certified interrupting capacities of 100,000 KVA at 2400 volts, 150,000 KVA at 4800 volts — an important consideration when starters were selected for the 1250-hp, 4800-volt starters at Wyandotte Pumping Station. This inherent fault protection is an EC&M "exclusive" — and is available with no first-cost premium.

EC&M starters are safe and easy to maintain. A three-way door interlock gives positive personnel protection, and an interlock is provided between the contactor and disconnect switch. Disconnect blades are visible in the open position when the door is open. No roll-out or draw-out needed for maintenance. All six contacts can be replaced without special tools in 10 minutes or so.

These cost-saving features make EC&M starters the logical choice for 2200-4800 volt motor drives.

TYPICAL SAVINGS WITH EC&M STARTERS

	Fused Starter	EC&M Fuseless Starter
Cost of 1250-hp 4800-volt Starter	$xxx.xx	Same as Fused Starter
Spare Fuse Costs: Set of 3 Spare Fuses for 1250 hp	$470.00	0

***SAVE** per starter, up to $500*
(more on larger motors)
...with EC&M Fuseless Starters

***Write** FOR DETAILS • Ask for Bulletin 8130*
Square D Company, EC&M Division, 4500 Lee Road, Cleveland 28, Ohio

SQUARE D COMPANY
EC&M DIVISION • CLEVELAND 28, OHIO
wherever electricity is distributed and controlled

6520

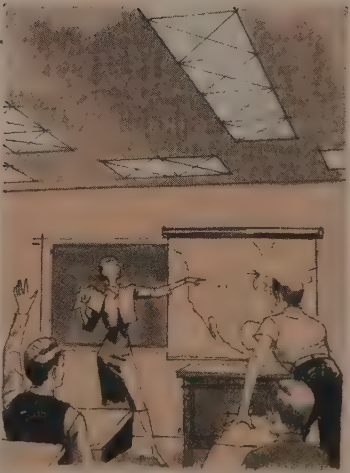
HOLOPHANE

Lighting Research
Develops a Totally
New Type of
Surface-Attached Luminaire

CONTROLLED
ILLUMINATION

CONTOURED TO

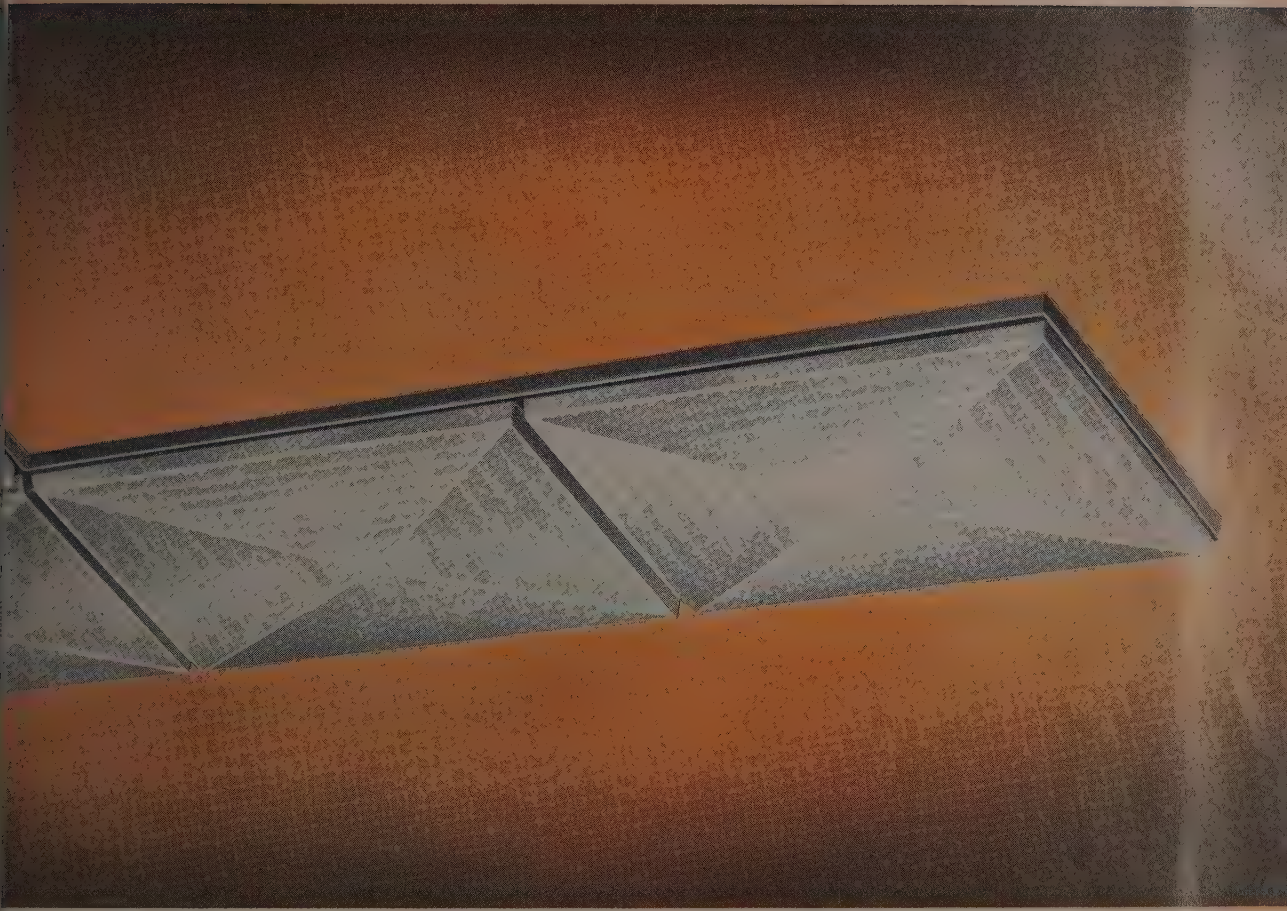
THE "NEW LOOK" IN LUMINAIRES... Extremely slim, crisp-lined 6600 Luminaires conform with all modern interiors... Their high-level lighting increases efficiency in offices, libraries, banks, drafting rooms.



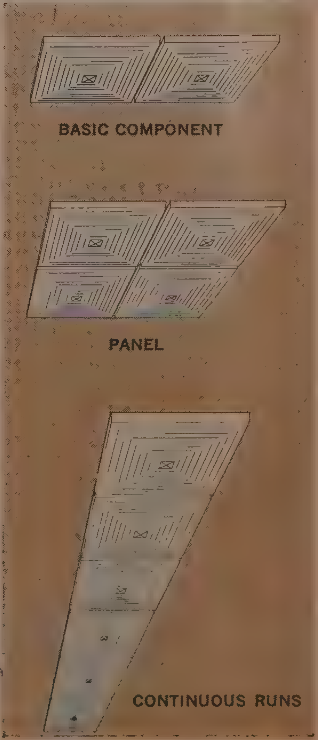
BETTER LIGHTING FOR EDUCATION... Flexibility of Series 6600 permits wide use in classrooms, laboratories, lecture halls... The prismatic CONTROLENS produces maximum light, total elimination of glare.

PANELS FOR SPACIOUS INTERIORS... In large department stores, showrooms, shopping centers these new luminaires assure comfortable viewing, speedy selection, satisfied customers and increased volume.

• HOLOPHANE SERIES 6600 •



NY AREA!



The dramatic advances of the "modular era" have posed new problems for lighting . . . To meet the challenge Holophane Engineers developed Series 6600—introducing a distinctive new luminaire and a startling concept that permits almost unlimited flexibilty of design.

Using the basic 2 ft. x 4 ft. component, containing acrylic plastic CONTROLENS®, these luminaires can be contoured to fit any area. They can be installed as single units—or aligned for continuous runs—or massed in panels—or tailored to go around corners . . . Their great versatility satisfies the designer who seeks *one* luminaire, for *all* lighting requirements throughout an entire structure.

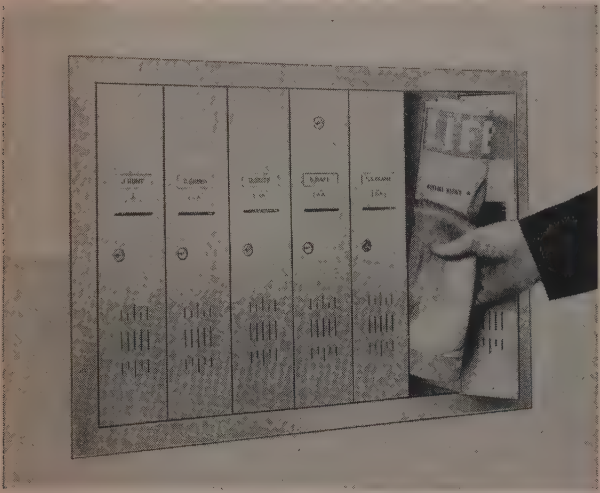
Add to these advantages, the quality features found in all Holophane lighting products—prismatic control for highest utilization of light, visual comfort, enduring construction and economy in installation and maintenance.

Write for Engineering Data

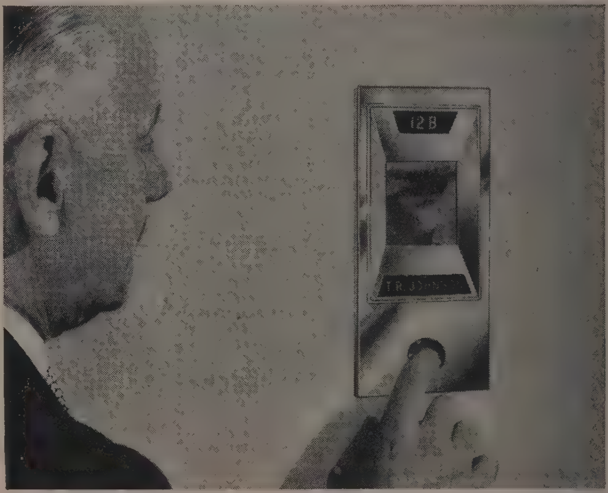
HOLOPHANE COMPANY, INC. *Lighting Authorities Since 1898*
342 Madison Avenue , • New York 17, N. Y.
THE HOLOPHANE CO., LTD., • 418 KIPLING AVE. SO., • TORONTO 18, • ONTARIO

VESTIBULE AND LOBBY TELEPHONES, *for communication with apartments, may be combined with mail boxes and alphabetical directories. New, modular design, cordless loudspeaking.*

APARTMENT TELEPHONES, *with new electronically-produced signals, are modern and streamlined. Simple, plug-in construction reduces installation costs, facilitates maintenance.*



"LIFE"-SIZE MAIL BOXES *do not bend or tear full size magazines or other mail because of the full-opening door design. Two-piece construction cuts down installation time, simplifies maintenance.*



NON-ELECTRIC DOOR CHIMES *are completely mechanical and provide lowest cost installation. Models available are: colonial knocker, pushbutton, one-way mirror viewer (illustrated).*

Only Auth Offers A Complete Line of

APARTMENT HOUSE COMMUNICATION EQUIPMENT

More and more architects, contractors and distributors are calling on Auth for apartment house equipment. The reasons? Auth offers the widest selection of apartment house telephone systems, mail boxes and non-electric door chimes available anywhere in the country. This means you can meet all your requirements from one dependable source. And—no matter how extensive or complex the installation, you're assured of identical high quality and efficiency throughout the building.

Most important for cost-conscious builders and contractors, Auth's 70 years of experience in manufacturing communication equipment for apartment house service means that every Auth product is engineered for easy, low cost installation, and minimum maintenance.

Auth "Life"-Size Mail Boxes, Vestibule-to-Apartment Telephone Systems, and Non-Electric Door Chimes pictured above are typical of the quality equipment supplied by Auth for thousands of modern apartment buildings. Many other types and models are included in the Auth catalog to meet virtually every apartment house requirement.

If you are not yet acquainted with Auth apartment house equipment, write for new Auth Catalog Section AM today. A copy is yours for the asking, without obligation.

Auth
SINCE 1891

Auth Electric Company, Inc.
LONG ISLAND CITY 1, NEW YORK

MANUFACTURERS OF APARTMENT HOUSE TELEPHONE SYSTEMS, MAIL BOXES, DOOR CHIMES, AND BELL SYSTEMS

run tests with Circle cable at University of Kentucky.

Circle's cooperation in university research programs means…

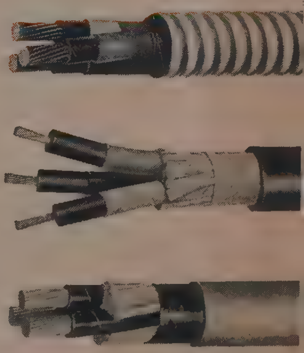
CABLE THAT MEETS TOMORROW'S NEEDS

Electrical engineering research programs being conducted in colleges and universities are vital to the continued progress of our industry.

Circle Wire & Cable is glad to cooperate fully with the universities to help assure the success of their projects. Circle has supplied reels of cable on a loan basis to a number of colleges engaged in the development of basic data on the behavior of cable under unusual conditions. At the University of Kentucky, for example, tests are being conducted, using Circle multiconductor cable, to develop basic data on skin effect and proximity effect on cable operated at 400 to 600 cps, 3 phase loading.

The results of these University of Kentucky tests and other basic research data developed in university laboratories contribute significantly to better cable design. This is the goal we continually strive for at Circle.

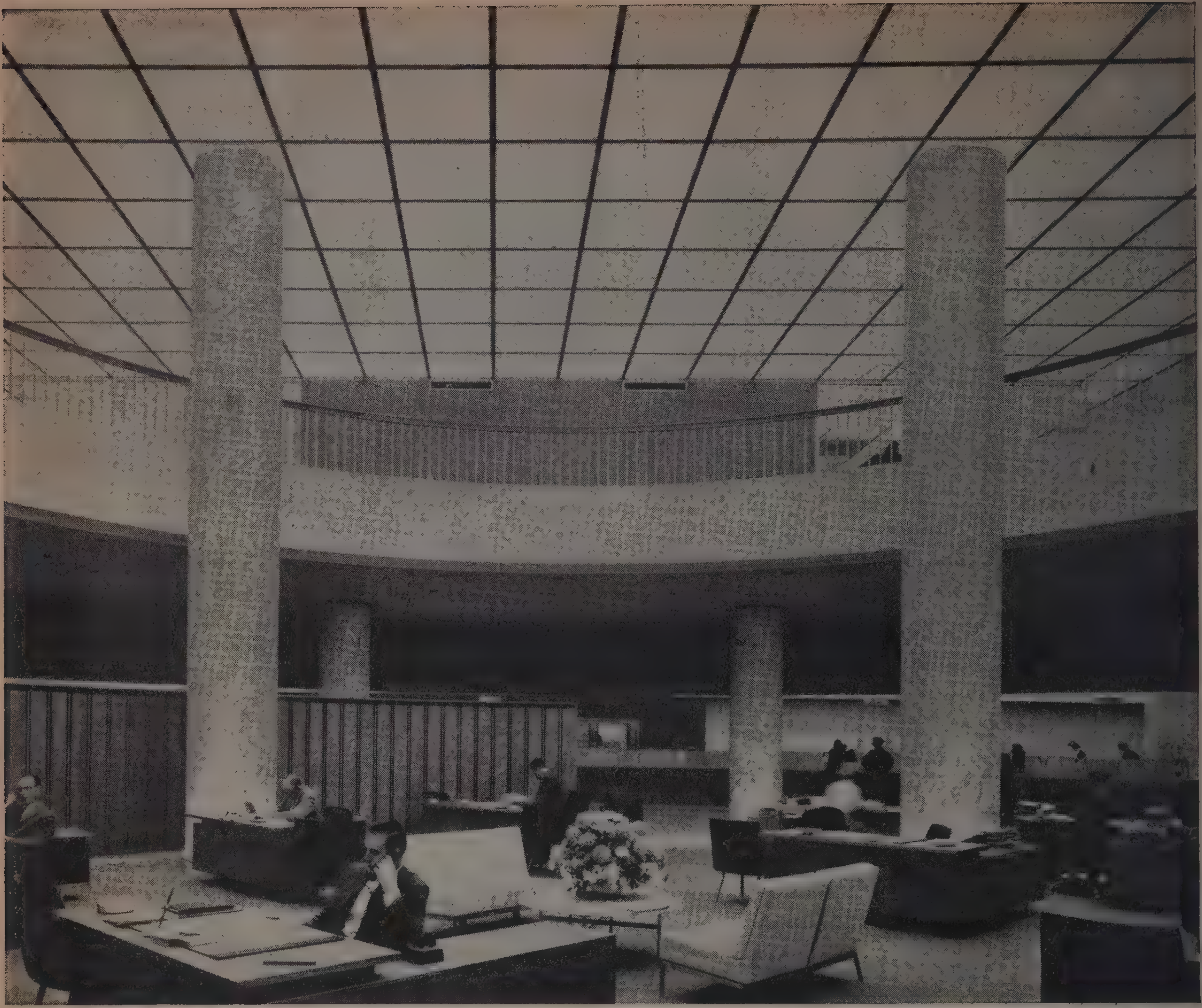
Specify Circle cable on your next job …there's no finer cable made.



CIRCLE WIRE & CABLE CORP.
SUBSIDIARY OF **CERRO CORPORATION**

PLANTS: Maspeth and Hicksville, N. Y. **SALES OFFICES & WAREHOUSES:** In all principal cities.

RUBBER COVERED WIRE & CABLE • VARNISHED CAMBRIC CABLE • PLASTIC INSULATED CABLE • NEOPRENE SHEATHED CABLE • CIRTUBE* EMT



Ceiling for the new California Bank main branch in Los Angeles. Interior designer, Henry Dreyfuss. Installed by Harold E. Shugart Co., Los Angeles. Ceiling made from BAKELITE Brand rigid vinyl sheet panels by Cepco, Inc., San Francisco, California.

A Bank Draws High Interest On Its
LONG-TERM INVESTMENT IN LIGHTING

There's a friendly, refreshing note in this Los Angeles bank's brilliant lighting. Glare-free and shadowless, the luminous ceiling is a snowy expanse of translucent BAKELITE rigid vinyl sheets suspended beneath fluorescent fixtures. The huge panels, four feet square, consist of a top and bottom sheet with an air space between and are placed in a metal frame under tension to facilitate handling. For years to come, the ceiling will stay as beautiful as it is. Accelerated aging tests show high resistance to ultra-violet light.

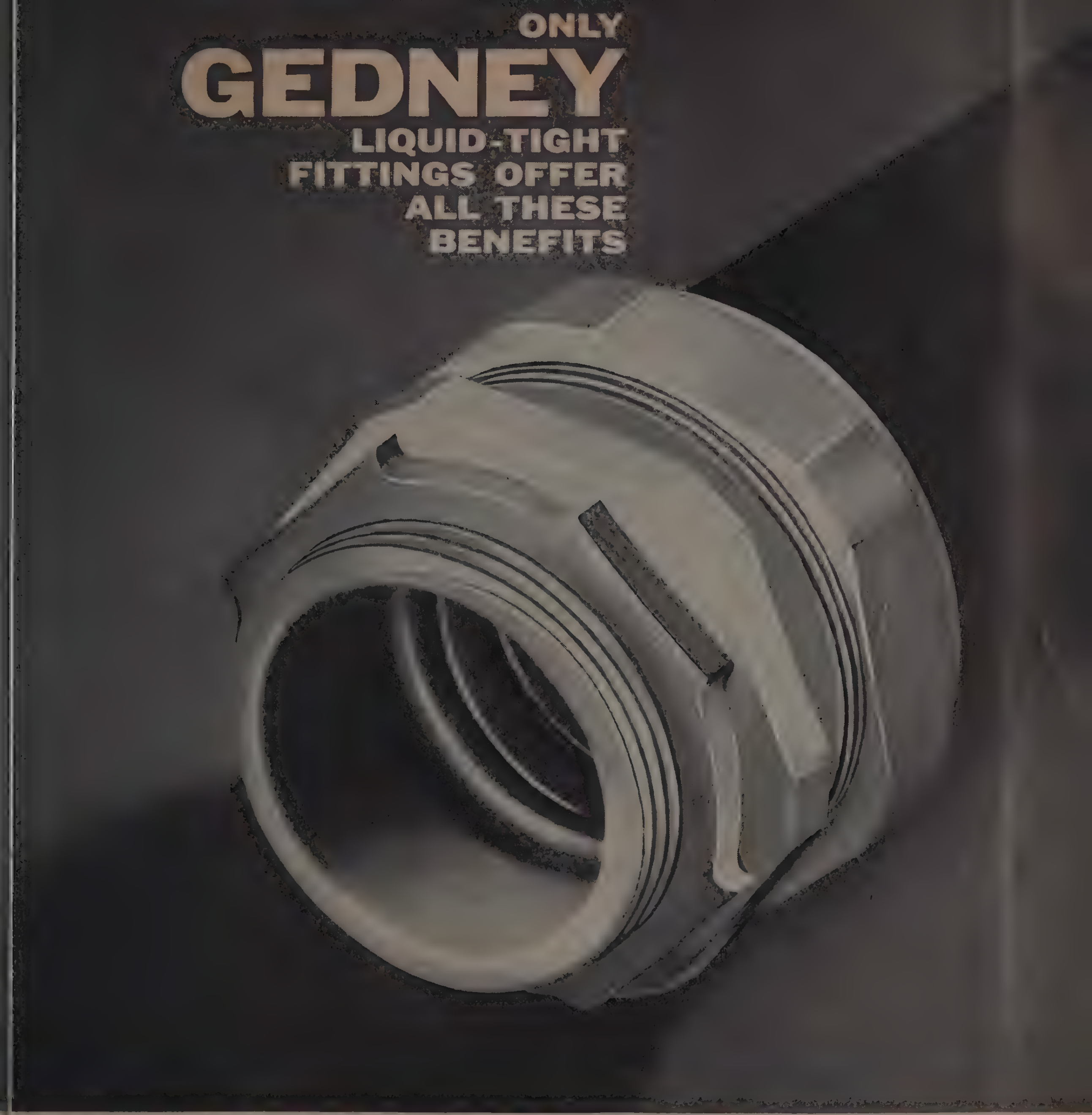
Now... high impact resistance! BAKELITE rigid vinyl sheets are now available with *new high impact qualities* that provide extra resistance to hard knocks . . . the wear and tear of installation and maintenance . . . cracking and warping. These sheets are normally unaffected by moisture and detergents, and, because of their light weight, they are easy to install, remove, and maintain.

New designs or renovations can be given a lift with better lighting. Install luminous ceilings made with *high-impact* BAKELITE rigid vinyl sheet. For information, write Dept. IX-41H, Union Carbide Plastics Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. *In Canada:* Union Carbide Canada Limited, Toronto 12.

BAKELITE and UNION CARBIDE are registered trade marks of Union Carbide Corporation.

UNION
CARBIDE

ONLY GEDNEY LIQUID-TIGHT FITTINGS OFFER ALL THESE BENEFITS



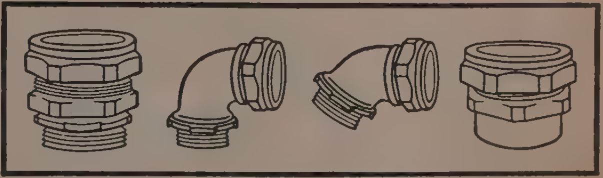
MAXIMUM PULLOUT. Extensive lab testing has proved onclusively that Gedney Liquid-Tight Fittings equal or exeed the breaking point of liquid-tight conduit...connections tart tight and stay tight through extra years of service life.

RE-USABILITY. Gedney Liquid-Tight Fittings can be used gain and again without destroying the *brass* grounding ferrule ..the liquid-tight conduit is never damaged or made unservceable in any way.

POSITIVE SEAL. Even the highest viscosity lubricants, oils r other liquids cannot penetrate the never-hardening vinyl ealing ring. The seal also effectively bars chemicals, fumes, lust and other foreign matter...Gedney Liquid-Tight Fittings erform better, longer, more reliably.

WIDE RANGE OF SIZES. Straight and 90° fittings from /8 in. through 4 in.—45° through 2 in.—combination rigid to iquid-tight from ½ in. to 1 in.

NSULATED THROAT. Available in sizes ½ in. through 2 in.



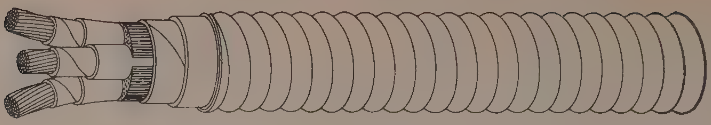
INDESTRUCTIBLE MALLEABLE IRON. Heavily plated ...the toughest metal known for fittings. Offers highest thread strength. Resists sharp blows and vibration.

When you can't take a chance on quality, specify GEDNEY Liquid-Tight Fittings. They're the finest you can buy. For descriptive literature, write or call:

GEDNEY

GEDNEY ELECTRIC COMPANY, INC.
1270 Sixth Ave., Radio City, N.Y. 20
Foundry, factory and shipping point:
Terryville, Conn.

Progress report from COLLYER . . .



Collyer POWER CABLE with INTERLOCKED ARMOR—

another progressive contribution to BETTER POWER CABLE

and BETTER INSTALLATION PROCEDURE . . .

Here is why and how it will help you

Assured Reliability
On installations in general and on critical applications in particular, Collyer Power Cable with Interlocked Armor provides the assurance and peace of mind which most people need and want. Because this cable eliminates on-the-job assembly of cable and conduit, it eliminates the hazards of strain and damage to which cable is frequently subjected when pulled into conduit. You are assured that the installed cable, free from installation strain or damage, retains all the original factory quality—so that it not only works when first energized but also provides maximum service life as well.

Important cost factors
Here in one assembly, "conduit" and cable are installed simultaneously. Factory-assembled Collyer Power Cable with Interlocked Armor can be installed faster and easier than the conduit and cable combination it replaces. Gone is the time and cost of cutting and fitting conduit. Gone is the cost of pulling cable . . . and the risk of delay or added cost due to cable damage caused by pulling. Space is saved, too, because the O.D. of Collyer Power Cable with Interlocked Armor is less than the O.D. of conventional cable plus conduit.

Flexibility
The flexibility of Collyer Power Cable with Interlocked Armor is another important feature. Whether the job involves new wiring, re-wiring, or re-locating existing wiring, obstructions present no problem because Collyer Power Cable with Interlocked Armor can be trained over, under, or around obstacles easily and neatly.

A Variety of Constructions
Collyer Power Cable with Interlocked Armor is available in many different designs to meet all kinds of special needs. The Armor may be aluminum, galvanized steel or bronze. The cable can be furnished with an overall protective sheath of polyvinyl thermoplastic where conditions require such precautions. Conductors are available with rubber, varnished cambric, varnished dacron and glass, silicone, asbestos, or plastic insulations depending on the particular requirements.

For more information ask your Collyer Distributor or Agent, or write for Specification Data Sheets to COLLYER INSULATED WIRE CO., 265 ROOSEVELT AVENUE, PAWTUCKET, RHODE ISLAND.

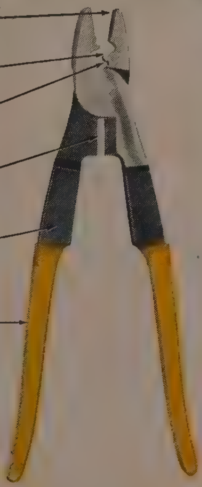
Collyer Cables

LOOK FOR THIS DISPLAY AT YOUR ELECTRICAL DISTRIBUTOR

IDEAL

new crimp tool FREE

WITH PURCHASE OF SPECIAL WRAP-CAP® WIRE CONNECTOR PACKAGE



special offer !

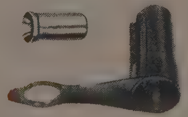
New Crimp Tool	$\$4^{25}$
50 Large Connectors	3^{03}
300 Small Connectors	8^{25}
	$\$15^{53}$ VALUE

you pay only... $\$11^{28}$

CRIMP and WRAP-CAP NOW IN 2 SIZES . . . LARGE and SMALL

ORIGINAL STEEL SLEEVE . . .

. . . WRAP-CAP THE UNIQUE "DIAPER-WRAP"



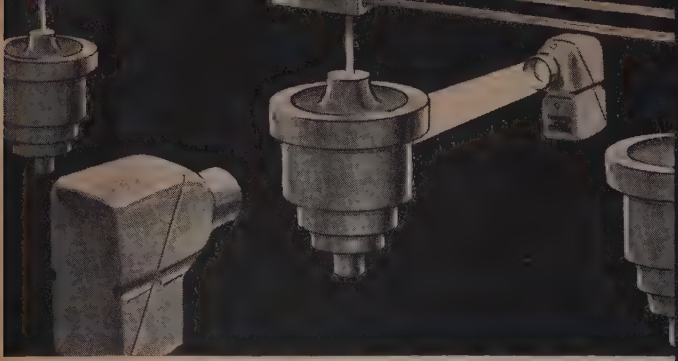
Splices from one #18 with one #14 up to two #10 with two #14.

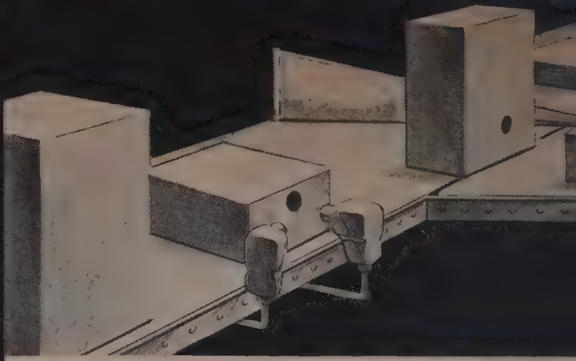
Splices from one #14 with one #16 up to one #6 with two #8.

Offer expires December 31, 1961

Printed in U.S.A.

IDEAL INDUSTRIES, Inc. • Sycamore, Illinois





PRODUCTION COUNTING

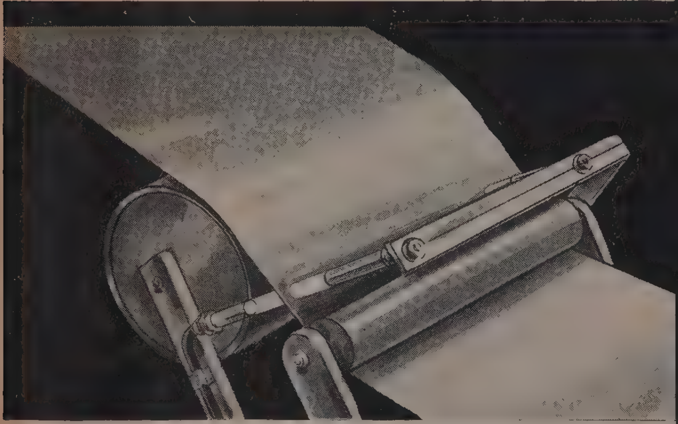
Problem: Stepped-up production rate made it difficult to count units accurately with existing mechanical equipment.

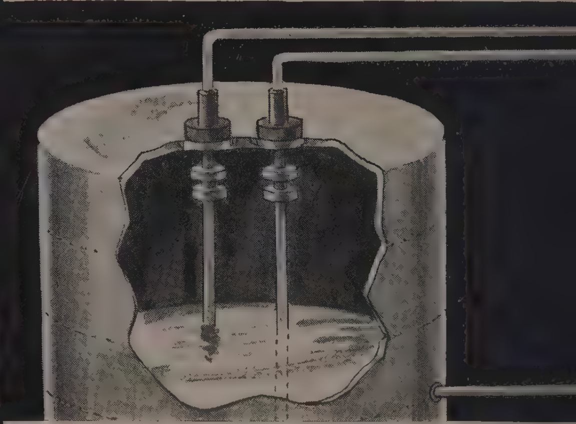
Solution: Plant Electrician installed two low-cost G-E photoelectric units connected to automatic counter. Even though production units come in bursts of over 150 per minute, this simple counting setup now tallies them swiftly and accurately.

SORTING DISSIMILAR CARTONS

Problem: To automatically divert selected boxes from main conveyor to side conveyor.

Solution: Plant engineer suggested printing black circular marks on those boxes to be diverted. The absence of reflected light from the marked boxes trips the G-E photoelectric units and switches boxes to side conveyor. Unmarked boxes continue straight ahead on main conveyor.





DETECTING WEB BREAKS

Problem: Paper mill experienced excess losses caused by web breaks and decided to investigate automatic detection equipment.

Solution: At G-E Application Engineer's suggestion, plant installed photoelectric web-break detectors. These units detect breaks instantly. Light penetrates through break to scanning photoelectric relay which immediately stops machine.

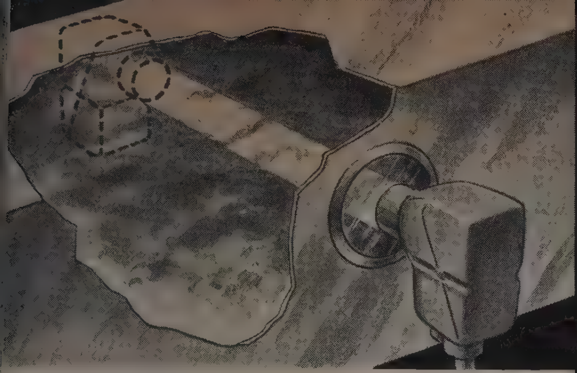
SENSING LIQUID LEVEL

Problem: Brewery planning to add 10 new vats wanted to equip them with most economical liquid level control.

Solution: At the Plant Electrician's suggestion, General Electric resistance-sensitive relays with stainless steel probes were installed on each vat. These standard devices have only one moving part, are easy to install, and require little maintenance.

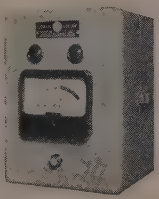
A complete line of photoelectric and electronic devices for controlling, sorting, limit

1. **Explosion-proof relay** is high-speed type in specia
closure for use in hazardous locations.
2. **Smoke density indicator** is designed for combu
control or alarm: range is adjustable from 3—1
3. **High-speed relay** offers .001-second sensitivity. It
includes time delay and interlock.
4. **Long-distance relay** will operate up to 2500 feet
out adverse effects from ambient light.
5. **Voltage-sensitive relay** operates on input signal vo
that ranges above or below pre-selected value.
6. **General-purpose relay** is low-cost, indoor-type p
electric relay, flexible to operate, easy to adjust.



MEASURING BURNING EFFICIENCY

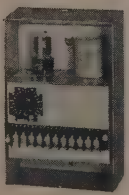
Problem: To determine that furnace vas operating economically, and well vithin local smoke ordinances.



Solution: Plant Engineer installed G-E electronic smoke density indicator. n addition to performing corrective ction, the indicator coupled with a trip chart recorder gives a day-by-day ecord of burning efficiency. It also atisfies local authorities that smoke is vithin prescribed limits.

AUTOMATIC CONVEYOR UNLOADING

Problem: Plant wanted to prevent eversing of loaded conveyor upon hut-down of hopper.



Solution: Plant Electrician wired imple electronic timer to hopper witch and to conveyor motor. When opper closes, timer starts, counts off 5 seconds (long enough for conveyor o dump load completely), then stops onveyor automatically.

ounting, and detecting applications

. **New high-speed relay** is a low-cost unit for use with niniature or micro-miniature source and cell.

. **Transistorized relay** features high reliability with niniature and micro-miniature source and cell.

. **Resistance sensitive relay** operates on change in ex-ernal resistance, ideal for liquid-level control.

0. **Electronic timer** is dial-set for given time; can be energized or de-energized before the timed interval.

1. **Light sources and receivers** are available in standard, niniature, and micro-miniature sizes.

2. **Self-contained relay** is low-cost, compact, tubeless photoelectric relay, ideal for limit-switch-type applications.

CONTROLS
FOR AUTOMATION

6 production problems SOLVED with General Electric electronic devices

These six production problems, and hundreds like them, are today readily solved with versatile General Electric electronic devices.

Applied with ingenuity, these devices now help plants sort, divert, detect, count, and perform other operations efficiently. And new uses turn up every day. For instance, the G-E resistance-sensitive relay is often used to control liquid level, but recently, it proved equally valuable as a thread-break detector!

Cash-in on such new uses of these versatile devices by contacting your authorized G-E Distributor early. He can solve many of your problems with electronic devices from stock. And his experience is invaluable on complex applications.

And for additional information on new ways to apply G-E electronic devices, return the coupon for your free copy of GEA-6822. General Electric Co. *Specialty Control Dept., Waynesboro, Va.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

FREE CATALOG

General Electric Co., Section E793-05
Schenectady 5, New York

Please send me a copy of the G-E Electronic Devices catalog, GEA-6822, with description, specifications, and pricing data on the complete line.

Name________________________

Company______________________

Address______________________

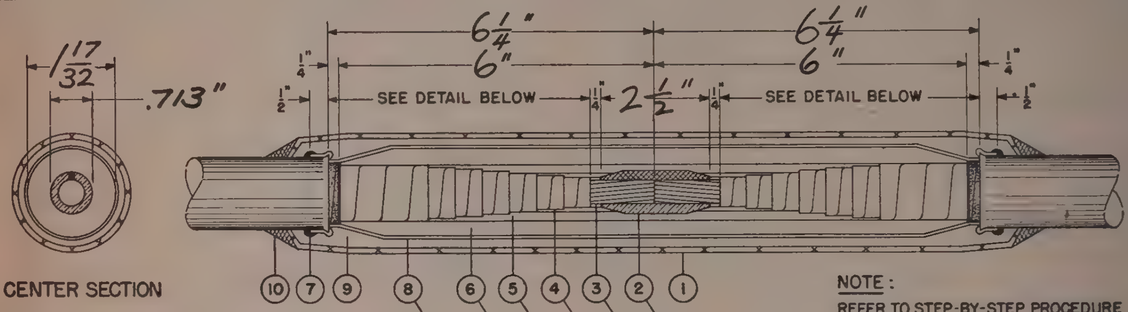
City______________ State________

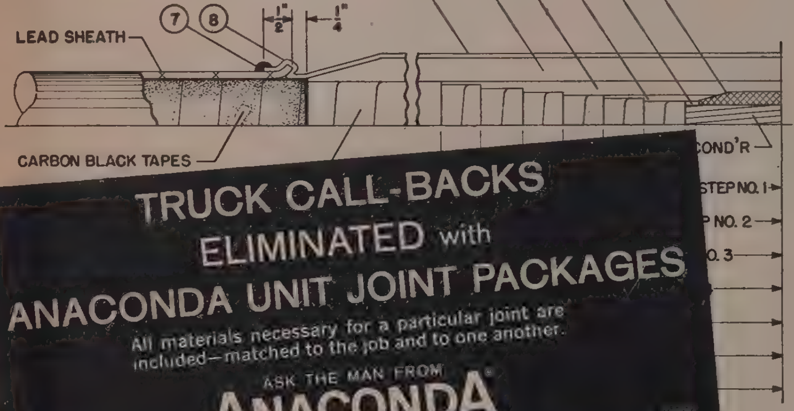
FOR John Doe
Electric Company
C.O. NO. 43967 ITEM 2
F.O. NO. 2-A-3695 ITEM 2
NO. OF UNITS 30
BY JEH DATE 4/5/61
APP. ACL DATE 4/5/61

ANACONDA WIRE & CABLE CO.
ENGINEERING DEPARTMENT
ANACONDA
from mine to consumer
HASTINGS-ON HUDSON, N.Y.

UNIT PACKAGE
JOINTING MATERIAL

STRAIGHT JOINT FOR TYPE CB
PAPER-LEAD CABLE
ONE CONDUCTOR, SIZE 4/0 AWG ~~MCM~~
CONDUCTOR SHAPE ROUND
INSULATION THICKNESS .175" ~~/64~~"
LEAD SHEATH THICKNESS .090" ~~/64~~"
RATED VOLTAGE 15 KV GRD. ~~UNGRD.~~





TRUCK CALL-BACKS ELIMINATED with ANACONDA UNIT JOINT PACKAGES

All materials necessary for a particular joint are included—matched to the job and to one another.

ASK THE MAN FROM ANACONDA® FOR UNIT JOINT PACKAGES

61249

NOTE:
REFER TO STEP-BY-STEP PROCEDURE FOR DETAILS OF STANDARD JOINTING OPERATIONS.

STEP NO.	LENGTH INCHES	TAPES TO REMOVE
7	—	—
6	—	—
5	6	CB TAPES
4	3 3/4	11
3	3	8
2	2 1/4	7
1	1 1/2	ALL

BILL OF MATERIAL CATALOG NO. 58111654-0-04

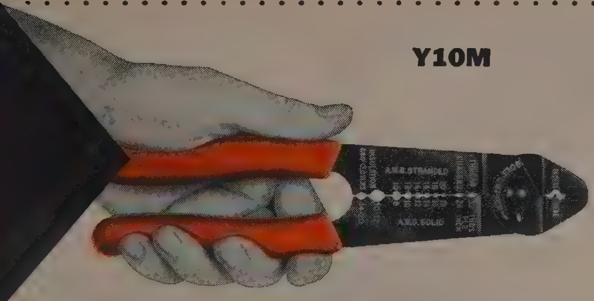
ITEM NO.	DESCRIPTION	QUANTITY PACKED
1	LEAD SLEEVE 2" IN. I.D. x 16 IN. LG. x 8/64 IN. WALL	1
2	SPLIT TINNED COPPER CONNECTOR, SIZE 4/0 AWG ~~MCM~~	1
3	V.C. TAPE, 3/16 IN. WIDE x 4 YD. PER ROLL	1 ROLLS
4	V.C. TAPE, 1/2 IN. WIDE x 4 YD. PER ROLL	1 ROLLS
5	V.C. TAPE, 3/4 IN. WIDE x 4 YD. PER ROLL	2 ROLLS
6	V.C. TAPE, 1 IN. WIDE x 4 YD. PER ROLL	9 ROLLS
7	BAR SOLDER	1/2 LB.
8	COPPER MESH TAPE, 3/4 IN. WIDE x 6 YD. PER ROLL	1 ROLLS
9	FILLING COMPOUND, NO. 150 SUPERSEAL	2 PINTS
10	WIPING SOLDER	2 LB.
11	FLUSHING COMPOUND, NO. 250 SUPERSEAL	1 PINTS
12	STEARINE FLUX	1 OZ.
13	PAPER PASTER	4
14	COTTON TAPE, 1 IN. WIDE x 3 YD. PER ROLL	1 ROLLS
15	COTTON YARN 1/8 OZ. PER ROLL	1 ROLLS
16	WASTE ENDS	2 OZ.
17	ALOXITE CLOTH	1-1FT. ROLL

OIL PACKED IN #300 SUPERSEAL

GET THE BIG 3

IN COMPRESSION-CONNECTOR TOOLING

1



Y10M

Light-weight hand tool installs a wide variety of HYDENT® connectors on wire sizes #22 thru #10. A wire cutter and single indentor die for all wire sizes are in the nose of the tool. Other features are wire stripper, bolt cutter, thread chasers, and dies for closing insulation-grips.

$3.95 ea.

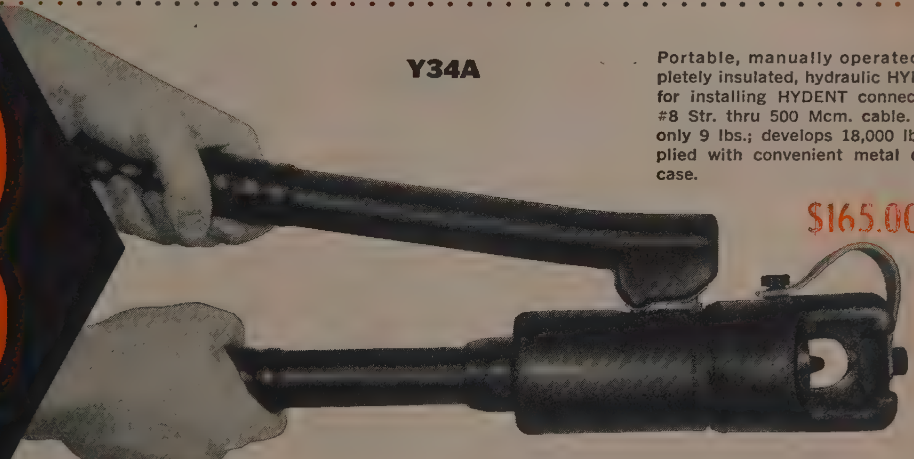
2

MY29-3

This HYTOOL® features one easily adjusted die set that installs HYDENT on commercial copper cable from #8 to 250 Mcm. and on aluminum conductors #8 to 4/0. Indexing plates are used for setting adjustable nest die for either copper or aluminum. No dies to install, change, identify or lose.

$39.50 ea.

3



Y34A

Portable, manually operated, completely insulated, hydraulic HYPRESS® for installing HYDENT connectors on #8 Str. thru 500 Mcm. cable. Weighs only 9 lbs.; develops 18,000 lbs. Supplied with convenient metal carrying case.

$165.00 ea.

Contractors with an eye on cutting connector installation time count on the Burndy Big 3. This Y10M, MY29-3, Y34A combination crimps practically every type and size compression connector on any job...adds the versatility, speed, and economy that result in profitable jobs. See your local Burndy distributor for demonstration.

BURNDY

Norwalk, Connect. In Europe: Malines, Belgium Toronto, Canada

59-15

in this day of

Prismatic Light Control

Art Metal
introduces a new line of
Aluminum Recessed
and Surface Rounds
with Regressed Prismatic
Amcolenses*

The prismatic Amcolenses are regressed above the ceiling to lessen glare and provide an architecturally pleasing ceiling surface. Housing and exposed frames are made of aluminum for ultimate dependability, indoors and outdoors, particularly in coastal areas. Write for Bulletin RR1-961.

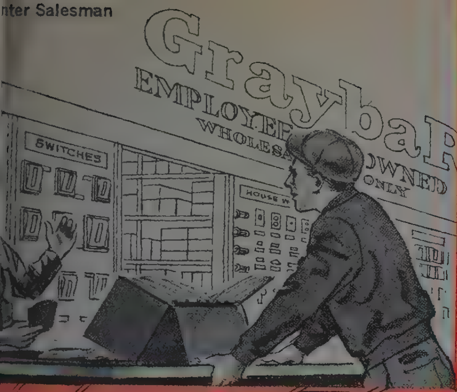
Also available with white Amtex glass diffusers.

WAKEFIELD
CORPORATION

ELECTRICAL PRODUCTS GROUP
Art Metal Lighting Division — Cleveland 3, Ohio
1814 East 40th St.
Wakefield Lighting Limited — London, Ontario

Wakefield Lighting Division — Vermilion, Ohio
Sta-Warm Electric Company — Ravenna, Ohio

nter Salesman



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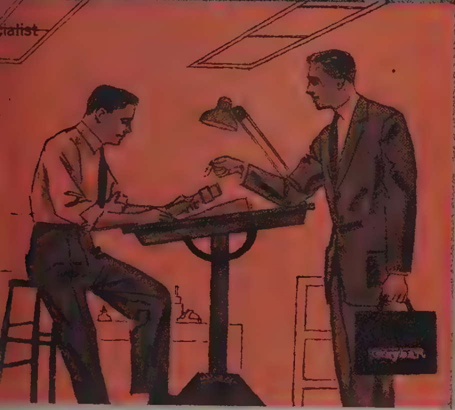


MORE THAN 60 WAYS TO SAVE TIME AND MONEY

GraybaR's IDEA BOOK #4

• Must reading for Contractors, Utility Engineers, Plant Engineers and Electrical Superintendents, Purchasing Agents!

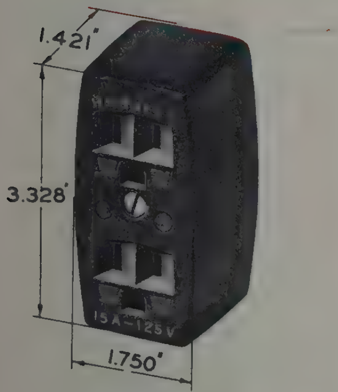
Inside Salesman

The GRAYBAR TEAM

The men shown at left are ready, right now, to serve you . . . or give you quick delivery on any of the products in this booklet. Graybar Service is Special Service. It includes: Objective recommendations. On-the-job technical help. Most complete lines. Planned stocks to meet your needs. Faster counter service. Speedy handling of will-calls.

Outside Salesman

Fast, Temporary Conversion to 3-Wire GROUNDING SAFETY



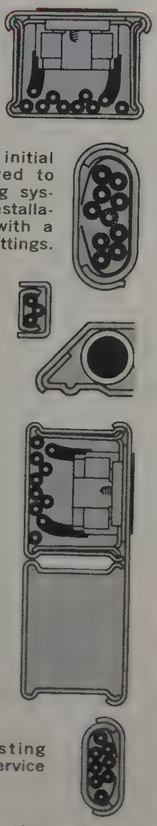
Cat. No. 5291 Duplex Adapter
also available in ivorine

Plug-in adapter converts 2-wire duplex receptacles to temporary 3-wire grounding receptacles. Nothing in existing system has to be removed except receptacle cover plate screw to make room for captive screw in each adapter. Captive screw acts as grounding conductor. Green binding screw permits connection of independent ground wire in ungrounded systems. Operates in any parallel or T-slot duplex receptacle with metal or plastic cover plates. Circle number 1 on the Graybar postcard.

HARVEY HUBBELL, INC.

NATIONAL ELECTRIC SURFACE WIRING SYSTEMS

a complete line of raceways for flexible, low-cost wiring "on-the-surface"



ECONOMICAL—low initial investment compared to other raceway wiring systems . . . meets all installation requirements with a minimum number of fittings.

TIME SAVING—"Lay-in" design (no fishing) helps keep your installation costs low, profits high.

FLEXIBLE—surface mounting and two-piece "lay-in" design of NE Raceways mean instant accessibility to meet changing electrical needs.

MODERN—streamlined contour and attractive finish blend with both old or new interiors.

DURABLE—rugged, heavy-duty construction gives lasting strength, safety and service life.

Circle number 2 on the Graybar postcard.

NATIONAL ELECTRIC DIVISION
H. K. PORTER COMPANY, INC.

New High Voltage Requirements Spur Residential Usage of TRIANGLE EMT

Because of the many appliances now found in the average home—and the consequent high voltage requirements—Triangle EMT is now finding wide residential usage. It eliminates the possibility of children making contact with these higher voltage conductors with pins, knives and the like.

Triangle EMT is built to last, too. It's electro-galvanized on the outside with a 99.9% pure zinc coating and silver finished inside to give maximum protection against corrosion. Uniform ductility is assured in every foot of thin-wall coating by the exclusive Triangle welding process . . . which means smooth, accurate bends without kinking.

For a safer home . . . and a more efficient one . . . recommend Triangle EMT on all residential jobs. For more information, circle Graybar postcard number 3.

TRIANGLE CONDUIT & CABLE CO., INC.

COPYRIGHT 1961, GRAYBAR ELECTRIC COMPANY, INC.

Yours FREE: Fact-filled bulletins—selector guides, samples ... USE CARD ON INSIDE BACK FLAP!

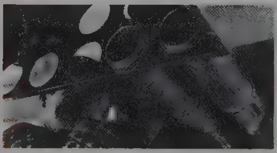
Phelps Dodge TUFPLY Portable Cable For Maximum Flexibility and Resistance to Abrasion

Used and proven in Phelps Dodge's own mining operations for years, this cable assures you the maximum in protection in locations which are subjected to mechanical and electrical hazards. P-114-BM listing where required.

For information and specifications on the full line of Phelps Dodge cables, circle number 4 on the Graybar postcard.

PHELPS DODGE COPPER PRODUCTS CORP.

Cut Installation Costs with REYNOLDS ALUMINUM Rigid Conduit!



Reynolds Aluminum Conduit weighs only ⅓ as much as steel. It can be handled and installed easily, is easy to cut and thread.

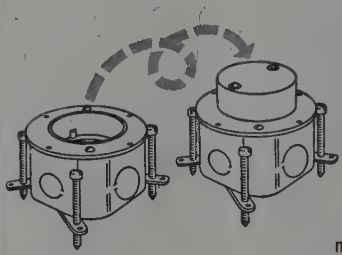
Our illustrated brochure shows the complete range of sizes, and offers many hints on using this time-and-money saving conduit. For your free copy, just circle number 5 on the Graybar postcard.

REYNOLDS METALS COMPANY

Fast Installation

SERIES '88' FLOOR BOXES

The simplified assembly of '88' Series Floor Boxes assures fast installation, true leveling and quick access to wiring—at low cost.

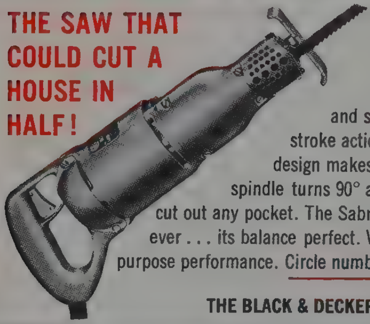


'88' Series boxes are packaged with metal protective cap in place. Simply reverse the assembled top and install box.

For more information, circle number 7 on the Graybar postcard.

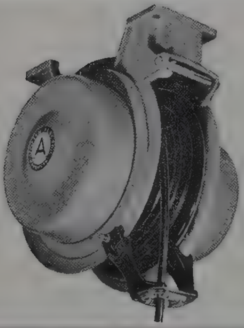
STEEL CITY ELECTRIC COMPANY

THE SAW THAT COULD CUT A HOUSE IN HALF!



The new Black & Decker Sabre Saw power-cuts clean through wood and plaster, metal pipe and sheet . . . with exclusive long-stroke action. Unique rock 'n' lock shoe design makes your work easier yet. Blade spindle turns 90° and 180° to cut in any corner, cut out any pocket. The Sabre Saw vibration is the lowest ever . . . its balance perfect. Wider range of blades for all-purpose performance. Circle number 6 on the Graybar postcard.

THE BLACK & DECKER MFG. COMPANY



AUTOMATIC CABLE TAKE-UP REELITES BY APPLETON

A newly designed weatherproof and explosion-proof reelite for industrial use incorporating a host of new features has been marketed by Appleton Electric Company.

This new model reelite, called the "RL" Reelite series, features one piece lightweight uni-cast main frame for perfect alignment, snap-on or threaded collector ring and spring housing covers doing away with screws and allowing release in seconds.

An exclusive self-contained safety spring cartridge permits practically instant spring replacement, if required. For full details on this new series of weatherproof and explosion-proof reelites, get Appleton Bulletin No. 505. Circle number 8 on Graybar postcard.

APPLETON ELECTRIC COMPANY

HEALTHFUL COMFORT . . . Wesix Automatic Ionix Portables:

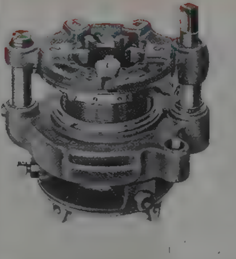
- Filter out excessive positive ions
- Destroy airborne bacteria
- Easy to reach thermostat
- Guaranteed 10 years against element burnout

For completely automatic electric heating in one or more rooms or for general auxiliary heating. Wesix Ionix unit keeps the air fresh as well as pure and germ-free. It is easily cleaned and safe for children.

For more information on Wesix products please send for free literature. Simply circle number 9 on the Graybar postcard.

WESIX ELECTRIC HEATER COMPANY

NEW rigid geared threaders save time—cut costs—on all large threading jobs—3 big advantages:



1. Only one set of high speed dies needed to thread 2½", 3", 3½" and 4" pipe and conduit. Die size selector plate sets quickly to size—easy adjustment for straight, tapered, over or undersized threads.
2. Jam Proof for safe power threading. Drive pinion kicks out automatically.
3. New Fast Action Cam-Type Workholder sets to size by turn of collar. Set screw holds work centered for perfect threads every time.

For information, circle number 10 on Graybar postcard.

RIDGE TOOL COMPANY

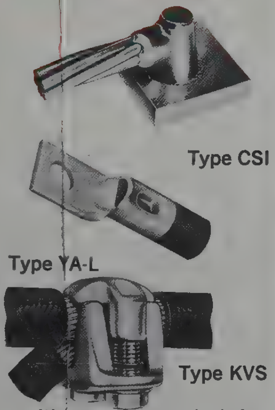
MAKE GRAYBAR YOUR ON

Only from BURNDY... all three types of Connectors:

THERMOWELD®—A permanent, welded electrical connection. Self contained, it's quick, easy, economical to use.

COMPRESSION — Available in many types and sizes, HYLUG® is short barreled for tight spaces. Only one indent required.

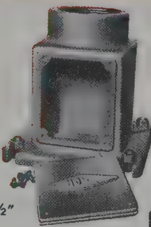
BOLTED—OKLIP® for high strength, easy application. Rubber-like rings capture and hold bolts for permanence.



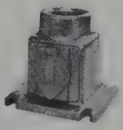
For our Industrial Pocket Catalog with complete code information, simply circle number 11 on the Graybar postcard.

BURNDY CORPORATION

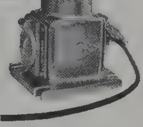
REDUCE OUTDOOR LIGHTING COSTS



Four Conduit Pipe Sizes
H42200–2″ H42250–2½″
H42300–3″ H42400–4″



Base with 3-pole 110v receptacle cover



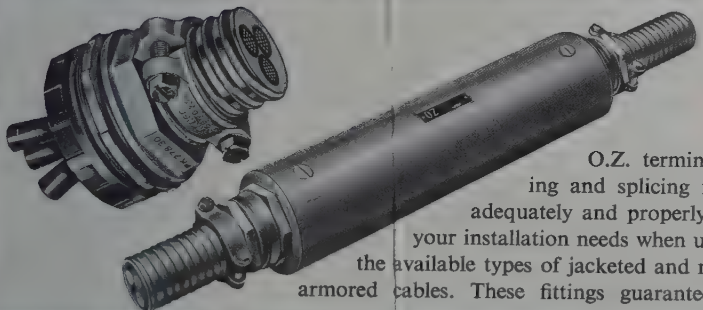
Base with two, 3-pole receptacle covers: 110v at front; 208v in back

© 1959

Specify the Original HOPE GALVANIZED MALLEABLE IRON POLE BASE

Attractive, rugged lighting poles easily fabricated by combining HOPE threaded Bases with standard galvanized conduit. Four Base sizes permit your fixture and elevation selection for a limitless variety of installations. Tapped deep for strong, locking engagement with pipe thread. Ample chamber for conduit stubs, splicing, grounding. For complete Bulletin G-25, circle number 12 on the Graybar postcard.

HOPE ELECTRICAL PRODUCTS CO.

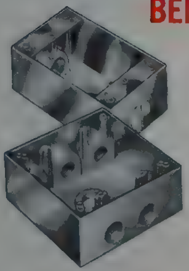


A COMPLETE LINE OF O.Z. FITTINGS FOR JACKETED AND NONJACKETED ARMORED CABLE

O.Z. terminating, sealing and splicing fittings will adequately and properly handle all your installation needs when using any of the available types of jacketed and nonjacketed armored cables. These fittings guarantee the user thorough protection under all conditions when properly selected.

For complete information, circle number 13 on the Graybar postcard.

O.Z. ELECTRICAL MFG. CO., INC.



BELL BOXES... Moistureproof! For Outdoor, Indoor Use

One-gang box available with 3 to 5 openings; two-gang, 3 to 7—in both ½″ and ¾″ reinforced, internal threaded hubs. Use with Bell Weatherproof outlets, switches, or as junction box. Universal type fits most standard covers, devices. Rugged, die-cast, corrosion-resistant. U.L. Approved.

Circle number 14 on the Graybar postcard.

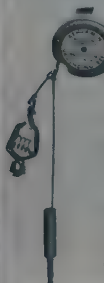
BELL ELECTRIC COMPANY

For low-cost installation and dependable operation, specify FEDERAL "Vibratone" Horns!

Here's a line of compact, powerful and self-adjusting electric horns that provide for the simplest installation imaginable. They mount in standard 4″ square outlet boxes, either surface or plastered-in. Unit extends just 1⅛″ beyond box. Includes volume control to adjust from a whisper to a 100 decibels. Modular accessories available provide 6 mounting variations for the 3 different models. Choice of AC or DC and wide-voltage varieties.

The complete line, along with dimensional and other data, will be at your fingertips if you write for our new Bulletin Number 105. Circle number 15 on the Graybar postcard.

FEDERAL SIGN & SIGNAL CORPORATION



Model 300-3-FN

NEW...GROUNDING DEVICE SAVES TIME, UPKEEP, EXPENSE

An effective, long-lasting ground is provided by the use of the Model 300-3-FN Grounding Reel for Aircraft Fuel Servicing Nozzles.

Benjamin has an extensive line of Grounding Reels and Electric Extension Cord Reels. For helpful data, circle number 16 on the Graybar postcard.

BENJAMIN REEL PRODUCTS, INC.

BRADY KEEPS YOUR NAME ON THE JOB

Card mounted, self-sticking nameplates stay on the job long after you complete it. They're "silent salesmen" that tell your customer to call you for future service. Brady nameplates are made of metallic aluminum foil or colorful vinyl plastic. They come on handy Blue Streak Dispenser Cards. Easy to carry—easy to apply. Just peel back Zip-Strip, remove nameplate, press on clean, dry surface. Sticks permanently. Choice of aluminum foil or all-vinyl materials.

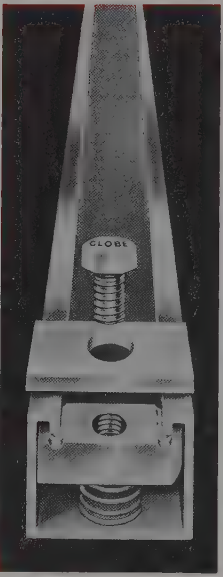
Cost? Little as 2c each.

Send for bulletin and free sample. Circle number 17 on the Graybar postcard.

W. H. BRADY CO.

E-STOP SHOPPING CENTER FOR

Speed framing and suspension work with GLOBE Channel and Fittings!



Globe Channel and Fittings can be used for any framing or suspension purpose. Set-up with a hacksaw and wrench, Globe Channels are completely re-usable, can be unlocked and set-up again in another location. Triple grip lock nuts are furnished for greater strength and there is a fitting for any purpose. Fluorescent fixture hanger fittings, porcelain cable clamps, concrete inserts, pipe clamps, shelf brackets, beam clamps and flat plate fittings, as well as custom engineered fittings and accessories are available to suit every need.

For information and literature showing complete range of fittings and accessories, simply circle number 18 on the Graybar postcard.

THE GLOBE COMPANY

NOW! LOOK HOW MUCH YOU SAVE BY SWITCHING FROM COPPER TO ALUMINUM SE-U!

At today's prices, aluminum SE-U saves you money over copper right down the line! Cost of braided #2 aluminum SE-U is 35% lower than #3 copper SE-U. Check the table below for cost comparison. (Neoprene jacketed aluminum cables offer similar savings.)

Service Entrance Cable, Braided
Full Neutral, Type SE, Style U

SERVICE	ALUMINUM		COPPER		SAVINGS	
Amperes	Size AWG	Cost M′	Size AWG	Cost M′	$	%
100	2	303	3	465	162	35
150	2/0	520	1/0	1083	563	52
200	4/0	704	3/0	1590	886	56

Send for a free copy of "K/W Service Entrance Cable." Just circle number 19 on the Graybar postcard.

KAISER ALUMINUM & CHEMICAL SALES, INC.

INTERMATIC Time Controls for faster installation and greater reliability!

For reliable Time Controls, specify INTERMATIC, the unit that gives you all these time and money-saving features:

- 40-Amp rating—4,375 Watts Tungsten
- Snap-out mechanism for fast, easy mounting
- E-Z See Dial for rapid and accurate settings
- Front-Mounted motor to quickly check operation without removing entire mechanism
- 31 cubic inches wiring space prevents cramped and skinned fingers

There's an Intermatic Time Control for nearly every timing need. Get your free catalog showing models, specifications, etc. — circle number 20 on the Graybar postcard.

INTERNATIONAL REGISTER COMPANY

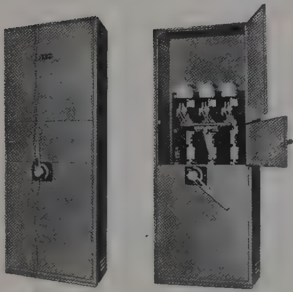
SAVE DOLLARS, HOURS!

Newest Shure-Set fastening kit is ideal for telephone installers, electricians, plumbers, every craftsman and contractor. MODEL R-550 Kit includes a work-saving Shure-Set tool, Shure-Drive® floating action hammer, assortment of fasteners. Compact, metal tool box takes up little space.

Special Model K-15 for telephone installers available, too.

For details, circle number 21 on the Graybar postcard.

RAMSET FASTENING SYSTEM



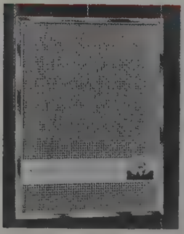
For maximum current carrying and load interrupting characteristics . . . BOLT-LOC® PRESSURE CONTACT LOAD BREAK SWITCHES

Here's a line of pressure contact load break switches for service entrance, feeder and industrial use that far exceeds maximum operational and safety requirements. Will interrupt extremely high short circuit currents when equipped with current limiting fuses. Furnished standard with quick-break mechanism, replaceable arcing tips, and double slot steel plate arc quenchers. For 1200 to 4000 amperes, 240 and 600 volts. Available unmounted or in free-standing or wall-mounted NEMA 1 enclosures; also, dust-tight and outdoor enclosures.

Our BOLT-LOC Bulletin Number 101 describes the complete line and illustrates all the built-in advantages of these unsurpassed switches. For your copy, circle number 22 on the Graybar postcard.

BARKELEW ELECTRIC MFG. CO.

NEW! Emerson Electric Fan Forced Heater



Instant high capacity air heating . . . fan circulates heat throughout the room . . . built-in thermostat provides controlled comfort level . . . no ductwork required.

For information on Emerson Electric . . . the most complete line of residential and commercial equipment . . . circle number 23 on the Graybar postcard.

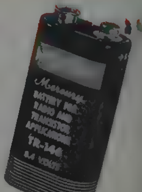
EMERSON ELECTRIC

NEW BATTERY SYSTEMS for . . . Flashlights, Instruments and Portable Electronic Equipment

Mallory Mercury Batteries
Mallory Manganese Alkaline Batteries

- Long Service Life
- Long Shelf Life
- More Sound Power
- Never Leak

Circle number 24 on the Graybar postcard.



MALLORY BATTERY COMPANY

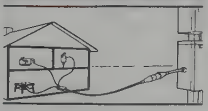
EVERYTHING ELECTRICAL!

NEW from BERNZ-O-MATIC
Famous Propane Torch With Extra Fuel Cylinder Attached

Here's the tool for doing hundreds of maintenance, repair and construction jobs with an extra fuel cylinder to give you up to 30 hours burning time. Lets you do jobs easier and faster, with long lasting fuel supply.

For descriptive literature, circle number 25 on the Graybar postcard.

OTTO BERNZ CO., INC.



TUFFLINE CONTRACTOR'S PORTABLE POWER DISTRIBUTION SYSTEMS

Handy ... Dependable ... Safe

- UL Approved Components
- 3 Pole System
- Dynaprene Cord
- Neoprene Molded Connectors
- Waterproof
- Extensions Available
- Easily Stored
- Safety Engineered
- Easily Connected to Power

For descriptive bulletin, check number 26 on the Graybar postcard.

WHITNEY BLAKE COMPANY

A RED HOT ANSWER FOR A RED HOT PROBLEM!

Collyer Silicone Power Cables are designed to operate continuously with conductor or ambient temperatures of 150°C and will withstand intermittent rises to 200°C.

The outstanding heat resistance of these cables gives them:

Dependability and long life in hot locations whether dry or moist.

Very high current carrying capacity.

Get full details—check number 27 on the Graybar postcard.

COLLYER INSULATED WIRE CO.

The Safety Switch That Challenges Comparison...

BULLDOG'S General Duty Safety Switch

Minimum Arcing
Double Break Switching
Arc Control
Vacu-Break Principle
Pressure Contacts
Clampmatic Spring Action
Positive Switching
Direct Handle Operation
PLUS... All Current Carrying Parts Are Silvered

Available in NEMA 1 and NEMA 3R Enclosures . . . Competitively Priced. For complete information, circle number 28 on the Graybar postcard.

I-T-E CIRCUIT BREAKER COMPANY
BULLDOG ELECTRIC PRODUCTS DIVISION

HANDY "MARK-TIME" TIME SWITCH

Perfect *inexpensive* companion installation for automatic time control of:
Space Heaters
Attic & Bathroom Fans
Garage & Outdoor Lights
Evaporative Coolers

For use in Homes, Motels, Schools, Industrial Plants. Variety of Timings available—mounts in any standard wall box.

Circle number 29 on the Graybar postcard for complete information.

M. H. RHODES, INC.

PHILLIPS RED HEADS Cut Construction and Maintenance Costs

—Install easier, Hold with certainty

Phillips RED HEAD self-drilling concrete anchors offer the easiest, most economical and most reliable way to anchor any kind of electrical equipment . . . motors, power equipment, heavy conduit, cable trays, junction boxes, or what have you . . . to any concrete surface. RED HEADS are rapidly installed with any make or model impact hammer . . . and their wide margin of holding power makes them proof against severe vibrational loads. Look to RED HEADS if you wish to install with CERTAINTY.

For free technical literature, simply circle number 30 on the Graybar postcard.

PHILLIPS DRILL COMPANY

BABCOCK

Is the Ladder you are looking for

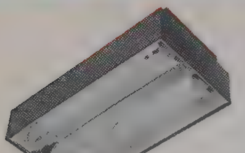
Good, strong durable Ladders of Top Quality

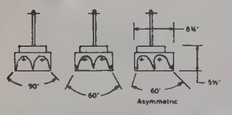
Moderate in price and long on service

ELECTRICIANS demand these superb Ladders. The best ever made. For free literature, circle number 31 on the Graybar postcard.

W. W. BABCOCK CO., INC.

REMEMBER *Graybar service includes: Objective recommendations. On-the-job technical help. Most complete lines.*



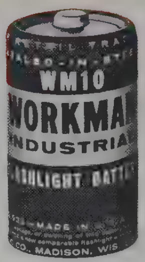


LUMINATOR

UL Approved Heat and Light Infrared Fixtures for Indoors and Outdoors

Luminator T3 Infrared one and two lamp fixtures are available in three reflector shapes, sizes 500 to 7600 Watts. They give 50% more radiant heat than quartz tube or metal sheath units with 8 lumens of light per watt . . . light and heat building interiors and outdoor areas. For Design Manual, circle number 32 on the Graybar postcard.

LUMINATOR, INC.



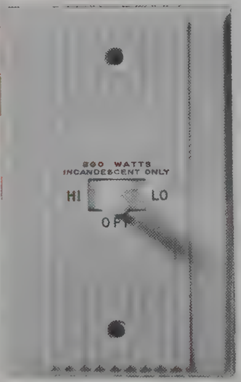
PRESTIGE PRODUCTS AT COMPETITIVE PRICES

With a sincere desire to better serve industrial users, Ray-O-Vac introduces the WORKMAN family of lighting batteries.

- Available in size "D" (WM10), size "AA" (WM40), size 6 (WM50) and 6 volt lantern battery (WM20).
- Specifically designed for industrial application.
- Write today for complete catalog. Circle number 33 on the Graybar postcard.

RAY-O-VAC COMPANY

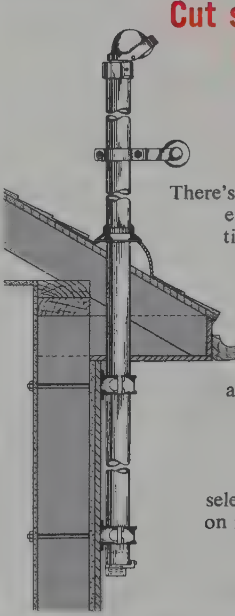
Low-Cost Leviton Hi-Lo Light Control Adds "Decorator-Lighting" in Seconds



This new two-stage dimming device replaces any standard single-pole switch, requires only two simple connections. It is designed with an integral wall plate. Brings a touch of luxury to any room in a home; ideal for numerous commercial applications. Rugged and efficient, it will outlast ordinary switches, saves current and extends lamp life when used in "Lo." Best of all it is inexpensive. Listed by Underwriters' Laboratories. Circle number 34 on the Graybar postcard for complete information.

LEVITON MANUFACTURING CO., INC.

Cut service entrance costs! M & W MAST KITS make installations faster, easier!



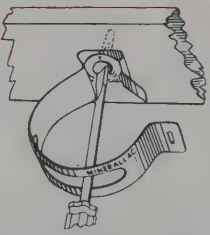
There's no faster, easier way to make service entrance installations than with handy, time-saving M&W Mast Kits. Each kit includes all the fittings you need for the job: no waste, no lost time, no extra costs. Kits for 1¼, 1½, 2 or 2½" conduit, including split-clamp conduit support, or one-hole strap with lag screws, and flashing with adjustable seal. You save, too, because kits cost less than individual fittings. Look to M&W, too, for a complete line of service entrance fittings. Complete literature showing the wide selection of all M&W fittings is available on request. For your copy, circle number 35 on the Graybar postcard.

THE M. & W. ELECTRIC MFG. CO., INC.

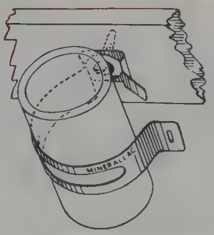
MINERALLAC "MINNY-TWIST" CONDUIT HANGERS save time, trouble and temper. Can be installed in just three easy steps.

No Protruding Ears or Bolts with "MINNY-TWIST" CONDUIT HANGERS.

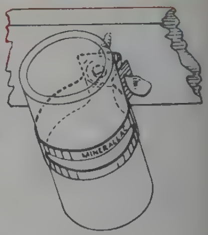
1. Install Hanger with Screw or Bolt. Convenient slot for Screwdriver.



2. Hang Conduit in Hanger. No Wrestling with Nuts, Bolts or Tools.



3. Insert Tongue in Slot. Twist Tongue with Tool supplied in each Standard Package.



For More Information Circle Number 36 on the Graybar Postcard.

MINERALLAC ELECTRIC COMPANY

Now! Everything You Need To Fasten To Any Kind of Masonry . . . In One Handy Package!

New Rawl Contractor's Kit puts the drills, anchors and screws, in the sizes you need, on the job where you need them. And all in a sturdy reusable hinged box. Each kit contains: 100 Genuine Rawlplugs, 100 Pan-Head Screws, 1 Carbide Drill.

Contractor's Kits save time and trouble. They're ideal for tool boxes. Come in three popular electrical sizes: #8, #10, #12. For more information, circle number 37 on the Graybar postcard.

THE RAWLPLUG COMPANY, INC.

Planned stocks to meet your needs. Expert counter service. Speedy handling of will-calls.

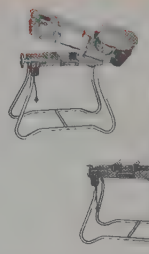
FOR BIG MACHINE QUALITY . . . AT ECONOMY PRICES . . . WELLS BAND SAWS

Would you like to make your metal cut-off jobs easier and more efficient . . . be able to cut conduit, pipe, angles, slots, notches and bevels on the same machine at the job site? If so, check the New Model 300 Wells Metal Cutting Band Saw. It does all this—and more. Just look at these value features:

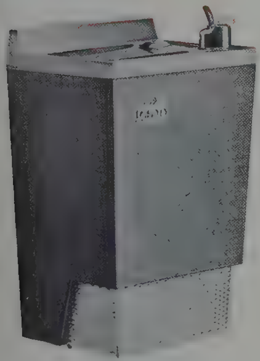
- Capacity: 3½" x 6" (3" pipe)
- Selective Speeds: 54, 100, 190 F.P.M.
- Gravity Feed and Automatic Shut-off
- Rigid Construction, Well Guarded
- Dual Purpose—Horizontal and Vertical
- Optional Wheels and Handle for Complete Mobility

For information on the New Model 300 Wells Metal Cutting Band Saw, circle number 38 on the Graybar postcard.

WELLS MANUFACTURING CORPORATION



NOW . . . The "trim look" in water coolers—the new OASIS ON-A-WALL



Smart, trim styling for new buildings or modernizing. Elegant Silver Spice Vinyl laminated to steel enhances any decor . . . has unequaled durability. Up-off-the-floor design for ease of cleaning. Gleaming splash-proof stainless steel top. Superbly engineered for trouble-free performance. Full 5-year warranty. For Bulletin 1162, including prices, circle number 39 on the Graybar postcard.

THE EBCO MANUFACTURING COMPANY

For High Temperature Wiring . . . Use ROCKBESTOS Silicone Rubber Wires and Cables

Rockbestos silicone rubber power cable, control cable, apparatus and motor lead wire, appliance and fixture wire and lighting wire offer these outstanding advantages:

- excellent heat resistance—125°C-200°C
- flame resistance
- corona and ozone resistance
- maintains flexibility from −130°F to −500°F
- excellent resistance to oil, solvents, fuels and chemicals
- and excellent electrical properties

For more information, send for the new Rockbestos Silicone Rubber Wire and Cable Selector. Simply circle number 40 on the Graybar postcard.

ROCKBESTOS

Jefferson DRY TYPE TRANSFORMERS

Jefferson's General Mounting dry types can be installed on floor, wall, ceiling—wherever it's most convenient. Large wiring compartments make for fast, easy installation. The rubber-cushioned core and coil provides quiet, efficient service. Single phase models to 100 KVA; three phase to 300 KVA.

Circle number 41 on the Graybar postcard for descriptive literature.

JEFFERSON ELECTRIC COMPANY

T-P ELECTRIC gives you Three-Phase Advantages on Single-Phase Lines!

Incorporate a T-P Phasing Unit with a three-phase motor and a standard fusible motor control and:

- Reduce initial and maintenance costs;
- Reduce starting surge on power line;
- Improve power factor;
- Eliminate need for heavy, expensive single-phase motors (Detach phasing unit when 3-phase service becomes available).

Choose from three models to fit any application. For complete information on all models, simply circle number 42 on the Graybar postcard.

T-P ELECTRIC & MFG. CORP.

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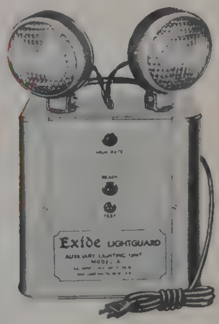
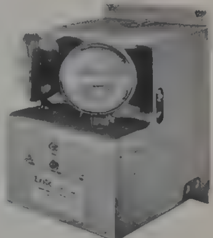
low cost emergency lighting protection EXIDE LIGHTGUARD



Quality Lightguard battery powered units made by Exide provide protection against sudden darkness caused by any type of power failure. A must for industrial plants, schools, hospitals, stores, etc. Relay monitors 110 AC supply—keeps battery charged — and lights lamps when power fails. Selection includes 100 A.H. Model E—30 A.H. Model A. With storage batteries and fully automatic two-rate charging. New low cost Model D dry cell unit. Additional lamps can be mounted remotely or on unit. Mounting bracket for easy installation. Units supplied with 2-wire cord set or ready for conduit connection. For full information, circle number 43 on the Graybar postcard.



EXIDE INDUSTRIAL MARKETING DIVISION
The Electric Storage Battery Co.

To obtain helpful literature on any or all products described in

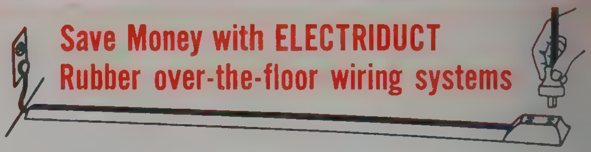
EIGHT BALL BEARINGS IN AN ELECTRIC DRILL!

If you picked one reason why the Thor ½" Silver Line Electric Drill is the best for industrial-type service, it could be its exclusive eight-ball-bearing construction. Add the triple insulated, Thor-built armature, precision hobbed steel gears, over-size switch . . . they all represent highest quality and heavy duty performance that can't be beat!

For complete information check number 44 on the Graybar postcard.

THOR POWER TOOL COMPANY

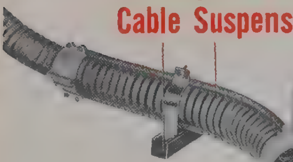
Save Money with ELECTRIDUCT Rubber over-the-floor wiring systems

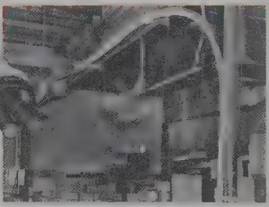


Stumbleproof Electriduct rubber over-the-floor wiring systems cost only half as much as permanent wiring systems. They're completely wired and ready to plug into any wall outlet . . . can always be moved and reused. Available in standard 4, 5, 6, and 10 foot lengths—as well as custom lengths—these Electriduct 2 and 3 wire systems are equipped with duplex outlets. For free sample and complete information, circle number 45 on the Graybar postcard.

ELECTRIDUCT DIVISION IDEAS, INC.

New LINE-FLEX®
. . . the simpler, extremely versatile Cable Suspension System!





CHECK THESE ADVANTAGES—

- No Installation Equipment Needed!
- Saves Time, Cuts Labor Costs!
- Designed for Flexible OR Rigid Use!
- Outperforms Old-Fashioned Methods!

Unique, lightweight LINE-FLEX offers obstacle-avoiding flexibility in one plane and non-sag rigidity in the other! Requiring *no* special equipment, tools or training to install, it can be used in non-supported rigid lengths of up to 14 ft. or in catenary applications of up to 400 ft. INSTALLS IN UP TO 25% LESS TIME! Several hundred feet of cable may be pulled through up to three 90° bends *by a 2-man crew* without damage or distortion.

Available in 2, 3 & 4"-dia. Galvaneal or Stainless Steel with full line of fittings, and accessories. FOR FREE CATALOG CIRCLE NUMBER 46 ON GRAYBAR POSTCARD.

LINE-FLEX DIVISION OF PERFECT-LINE MFG. CORP.

YOU GET MORE HOLES PER DOLLAR WITH PRECISION DRILLS AND TAPS

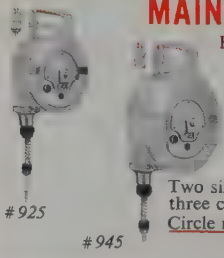
Specify PRECISION for:

- Faster, cleaner cutting for drilling and tapping holes in all kinds of materials
- Highest quality
- Precision taps and drills made in America by Americans

For information, circle Graybar postcard number 47.

PRECISION TWIST DRILL & MACHINE COMPANY

GUARANTEED MAINTENANCE FREE SERVICE



PRoTEX Industrial Duty Electric Cord Reels provide out-of-the-way storage for drop cord lighting equipment.

Reels feature ease of installation, maintenance free operation. Automatic lock for positive stop at desired point.

Ten year Warranty of material and workmanship guarantees service plus!

Two sizes offered, equipped with two conductor or three conductor grounded cord. Circle number 48 on the Graybar postcard.

DANIEL WOODHEAD COMPANY

Big Savings With TRUCO® Power Handsaw Abrasive Blades

Truco TruBond Break-resistant Abrasive Blades cut everything from toughest concrete to lightest, insulating brick. Ideal for any job where only a handsaw can be used. And, for many jobs, a handsaw with a TruBond Blade can make it unnecessary to invest in higher-priced equipment. Sizes from 6" to 12" in either ⅛" or ¼" thickness. For literature, circle number 49 on the Graybar postcard.

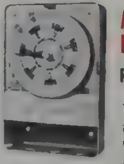
WHEEL TRUEING TOOL COMPANY

PORTABLE POWER WHEREVER YOU NEED IT "TOLEDO 68" IS THE HANDIEST TOOL TO OWN

Consists of worm and gear assembly powered by reversible ½ hp motor. Strong, rugged, lightweight frame. Adaptors, optional, convert it for many jobs. Takes die stocks up to 4". Equipped with square socket adaptors it will do cranking, turning large valves, lifts and hoists. It weighs only 33 lbs. Can be equipped also with air motor, if desired. Circle number 50 on the Graybar postcard.

THE TOLEDO PIPE THREADING MACHINE CO.

At Last! One Multi-Purpose Model 7 Day Calendar Dial Time Control . . . Paragon 7000 Series



Relay designed 4-pole switch offering pole-double throw action

The newest and latest in automatic timing on a weekly schedule . . . Paragon 7000 series 7 day calendar dial time controls with individual daily settings that distinctly separate day and night periods. It allows you to turn any electrically controlled system on and off automatically at different hours of each day desired . . . and any day or days can be omitted entirely. Ideal for use in schools, public buildings, stores, factories and offices.

Newest features include:

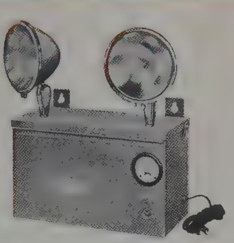
- 4-pole design with each pole completely isolated . . . 2 poles are in the open position and 2 in the closed.
- 40 amperes capacity . . . largest load carrying capacity of any 7 day time control.
- Easy to install.

For information, simply circle number 51 on the Graybar postcard.

PARAGON ELECTRIC COMPANY

NOW—AUXILIARY LIGHTING PROTECTION AT A PRICE YOU CAN AFFORD!

#2-75 BIG BEAM "LIFE SAVER" WILL DO THE JOB ECONOMICALLY—DEPENDABLY



#2-75 *"Life Saver"*

7½-V Dry Cell Battery
Five Continuous Burning Hours
Volt Meter • Two Swivel Heads
Neon Light • Wall Mounting Bracket

For more information, circle number 52 on the Graybar postcard.

U-C-LITE MANUFACTURING COMPANY

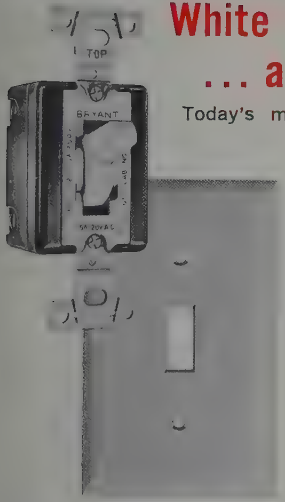
Feed machine tools without rigid conduit . . . with PWC Bus Drop Cable

Now you can provide flexible branch circuit runs between overhead bus feeders and electrically powered machine tools and equipment, with PWC Bus Drop Cables. Especially valuable for machine shops that must align machinery to fit varied production jobs. May be installed from a bus attachment or feeder raceway to the machine control box; standard fittings may be used. PWC Cable is highly resistant to damage by lubricants, cooling oils, impact and abrasion. Available in sizes from #14 to #2 AWG, with three insulated conductors and three grounding conductors.

For data sheets giving full description of PWC Bus Drop Cable (sizes, diameters, stranding, etc.) and accessories, simply circle number 53 on the Graybar postcard.

PLASTIC WIRE & CABLE CORPORATION

White Wiring Devices . . . a Bryant First



Today's modern architecture demands products that offer both quality performance and complimentary appearance. The wide variety of Bryant Wiring Devices . . . in sparkling white . . . answers this need for fine products in today's most popular color choice . . . pure white. Bryant White Devices are available in Fashion Plate Switches, A-C Switches, Mercury Switches, and in regular duplex and grounding receptacles and both "Uniiine" and the new "Smooth-Line" wall plates, plus the complete line of BECO devices and wall plates.

Send for descriptive literature. Just check number 54 on the Graybar postcard.

BRYANT ELECTRIC COMPANY

NEW OSTER FUSION TOOL For fast, economical joining of fusable plastic pipe and conduit

NO SKILLED LABOR NEEDED! Butt fusion is the strongest, quickest and most economical method of joining plastic pipe and conduit. Oster's new **FUSION TOOL** now makes fusion joining a simple matter. It speeds up all installations. Compact, and very light in weight, this unique, NEW, Oster Tool can be used practically any place—to complete a uniform, fused joint in seconds!

Circle number 55 on Graybar postcard for fully illustrated brochure with complete information and prices.

THE OSTER MANUFACTURING COMPANY

AMPROBE INSTRUMENTS SAVE TIME AND LABOR

AMPROBE. Rotary Scale Models. Pocket-size Amprobe rotary-scale models measure amps and volts quickly, accurately (RS-3 also measures resistance). No need to interrupt service or cut conductors. Rotary scale for faster readings. Lock "freezes" pointer at reading. Advanced printed circuitry laughs at rough handling. Advanced movement design—new internal core magnet with self-shielding characteristics.

CABLE TRACER. Now you can trace conductors 10 times faster than ever before and leave your helper free to finish other jobs quickly and profitably! Search—and unmistakably identify—up to ten separate circuits simultaneously, even in the dark and when color coding is absent or obscured by age and dirt. A pocket-size tracing system in itself, Cable Tracer also tests for opens and shorts. Circle number 56 on the Graybar postcard.

AMPROBE INSTRUMENT CORPORATION

DIAMOND PLASTIC SCREW ANCHORS

Engineered & Priced Right for Low-Cost Installations

Designed with effective anti-turning ribs, plus flat, concentric ribs for maximum holding power. Open throat permits easy insertion of wood or sheet metal screws.

FREE CHART-GUIDE TO FASTENER SELECTION

Send for this handy guide today. Simply circle number 57 on the Graybar postcard.

DIAMOND EXPANSION BOLT CO., INC.

NUTONE SURFACE MOUNTED RADIANT HEATER

It's so easy to install NuTone's Model 9290 Radiant Heater! Use it for new construction and for replacement of a standard ceiling fixture in remodeling. It mounts easily to standard 3″ or 4″ outlet box—provides even heat all the way to the bathroom floor! Thermal-protected heating element prevents over-heating. All exposed parts are Anodized Aluminum—won't rust, stain or corrode.

A NuTone color catalog describes all the NuTone door chimes, exhaust fans, range hoods, etc. To get yours, simply circle number 58 on the Graybar postcard.

NUTONE, INCORPORATED

GRAYBAR BRANCH OFFICES

ALABAMA
Birmingham
Huntsville
Mobile

ARIZONA
Phoenix
• Tucson

ARKANSAS
Little Rock

CALIFORNIA
Anaheim
• Bakersfield
Fresno
Long Beach
Los Angeles
Oakland
• Oceanside
Sacramento
San Bernardino
San Diego
San Francisco
Riverside
Santa Barbara
Van Nuys

COLORADO
• Colorado Springs
Denver

CONNECTICUT
Hamden
West Hartford

DELAWARE
Wilmington

DISTRICT OF COLUMBIA
Washington

FLORIDA
Ft. Lauderdale
Jacksonville
Miami
Orlando
• St. Petersburg
Tampa
West Palm Beach

GEORGIA
Atlanta
Columbus
Savannah

IDAHO
Boise

ILLINOIS
Melrose Park
Peoria
Springfield

INDIANA
Evansville
Hammond
Indianapolis

IOWA
Davenport
Des Moines

KANSAS
Wichita

KENTUCKY
Lexington
Louisville

LOUISIANA
Baton Rouge
Lake Charles
New Orleans
Shreveport

MAINE
Portland

MARYLAND
Baltimore

MASSACHUSETTS
Boston
Springfield
Worcester

MICHIGAN
Detroit
Flint
Grand Rapids
Lansing

MINNESOTA
Duluth
Minneapolis
St. Paul

MISSISSIPPI
Jackson

MISSOURI
Kansas City
Springfield
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MONTANA
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For your free copy of the literature you need, circle the numbers on the reverse of these cards and drop in the mail today!

CALL GRAYBAR FIRST FOR EVERYTHING ELECTRICAL

Hundreds of contractors stop, shop and buy at Graybar Counters every day. Here they find that Graybar offers them a time saving, money saving service combination that can't be matched elsewhere. ■ For instance, there's room to park (and load) for quick pick-ups or phoned in "will-calls." ■ There's complete catalog information and help on difficult "spec". ■ There's a warehouse full of electrical items to choose from—to take care of any job—large or small. ■ There's merchandise on display—new products to inspect and operate—tools to help cut job costs. ■ There's experienced Counter Salesmen—to give you faster, better service. ■ "Call Graybar first for everything electrical."

Whatever your electrical needs—plenty of everyday supplies, or hard-to-find specialized equipment—the best answer is to call Graybar

C-L-X *SEALED* CABLE SYSTEMS PROVIDE *UNMATCHED* ECONOMY!

Available with sheaths of steel, copper, aluminum or bronze

C-L-X continuous corrugated, metallic, sheathed cable systems offer an unmatched combination of physical advantages and economy. Highly resistant to all types of mechanical and chemical damage, and completely impervious to liquids and gases, they eliminate most of the costly and time consuming work involved in conventional installations.

Get free catalog #1043. Circle number 59 on the Graybar postcard.

SIMPLEX WIRE & CABLE COMPANY

SEND FOR FREE BOOKLET

Newest specifications on Sealtite®

Latest Bulletin No. S-544 on Sealtite, the original flexible liquid-tight wiring conduit by Anaconda. Specifications include diameters, bend diameters, shipping weights on all four types of Sealtite (U.A.—E.F.—H.C.—C.S.A.), also latest packaging. Included is information on another Anaconda product, Type DSL conduit. Circle number 60 on the Graybar postcard.

ANACONDA METAL HOSE DIVISION
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Specify MARATHON for Dependable Dry Batteries

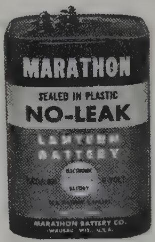
MARATHON offers a complete line of batteries for your portable power requirements.

For more information, circle number 61 on the Graybar postcard.

HIGHEST QUALITY—FAMOUS FOR ENDURANCE.

MARATHON BATTERY COMPANY

#122
Industrial
Flashlight



#49NL
Exclusive patented
No Leak Lantern

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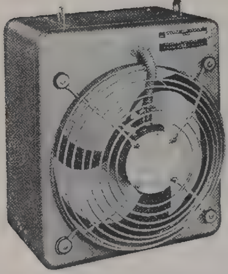
ILG Heaters For Quick Automatic Heat



Today's best answer to many space heating problems is found in the 14 ILG models with heating capacities from 1½KW to 36KW.

They're easily installed—just mount and connect to electric circuit—and can be operated by both manual and automatic control. ILG Electric Heaters are ideal for full or auxiliary heat requirements—freeze prevention—isolated buildings—for fast clean, quiet heat anywhere.

ILG ELECTRIC VENTILATING CO.

Special ILG features include:

- Whisper-quiet fan air delivery
- Black-heat elements protected by built-in thermal control
- Totally enclosed motor permanently lubricated
- Individually adjustable discharge louvers
- Suspension from ceiling or wall

Get your free copy of bulletin DB5-100 providing complete information. Simply circle number 62 on the Graybar postcard.

NEW Jet Line JETMASTER makes it easier than ever to install pull lines in underground conduits in seconds

The famous Jet Line method of installing pull lines in underground conduits in seconds—regardless of bends, mud or water—by propelling a cone with carbon dioxide has been improved upon. Now the entire Jet Line method is combined into one handy, compact, easily portable unit . . . the Jetmaster. It makes you a one man gang for all conduit wiring jobs . . . includes everything you need to pull wire in any size, any type conduit from ½" to 4" ID. In distances up to 1500 feet, it eliminates rodding and shaking . . . saves time and money. Three pipe sealoffs included: ½" thru 1"; 1½" thru 2"; 2" thru 4".

For detailed information, circle number 63 on the Graybar postcard.

JET LINE PRODUCTS, INC.

MAKE THE GRAYBAR COUNTER YOUR SHOPPING CENTER FOR EVERYTHING ELECTRICAL

Graybar is industry's one-stop source for everything electrical—from a simple wire nut to a complete packaged power and control cable system. A 100,000-item inventory, bearing the trademarks of America's best known manufacturers is available through more than 130 Graybar offices and warehouses located in every key U.S. industrial area.

CALL GRAYBAR FIRST FOR EVERYTHING ELECTRICAL

Everything Electrical Graybar

I-T-E BUILDS THE MOST USABLE FUSIBLE LOADCENTERS

Get more for your money! *Specify I-T-E!* Only I-T-E gives you rugged panelboard-type construction in a residential product . . . a model for *every* application . . . *plus separate packaging* that reduces your out-of-pocket costs and speeds installation!

Use I-T-E Fusible Loadcenters and you can buy the box separately . . . rough-it-in, and add the interior and trim later as the job progresses. All Uni-Pak boxes have a standard 14¼″ width and fit snugly between 16″ stud centers. The box almost *holds itself in place* as you secure with nails or screws to studs through quarter-inch knockouts. Get the whole story. *Write I-T-E Circuit Breaker Company, Walker Division, 125 Bennett Street, N. W., Atlanta 9, Georgia. Ask for Bulletin 561.*

New 1961 Speedfax Catalog just off the press!

Ask your I-T-E salesman for a new Speedfax catalog so you can have a handy quick reference to I-T-E products at your fingertips.

The HEART of HOUSEPOWER ⚡ NERVE-CENTER of the MEDALLION HOME

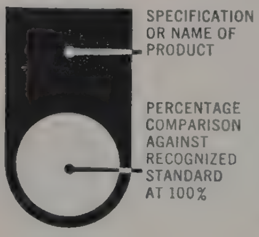
I-T-E CIRCUIT BREAKER COMPANY
WALKER DIVISION

NEW WAY TO EVALUATE CABLE!

"VALUE RATINGS" RELATE PERFORMANCE TO IPCEA OR COMPETITIVE STANDARDS

New Value Ratings tell at a glance the composite story of each Kaiser Wire construction—as it performed in as many as 25 specified tests. In each case a well-known standard serves as 100%:

For power cable, the Value Rating standard is all IPCEA test requirements for types of insulation and jacketing specified . . . For portable cord, the standard is service-per-dollar for the least expensive cord (C.V.) as proved by life-expectancy tests. . . . For control cable, the standard is a composite of minimum requirements for eight important insulation qualities.

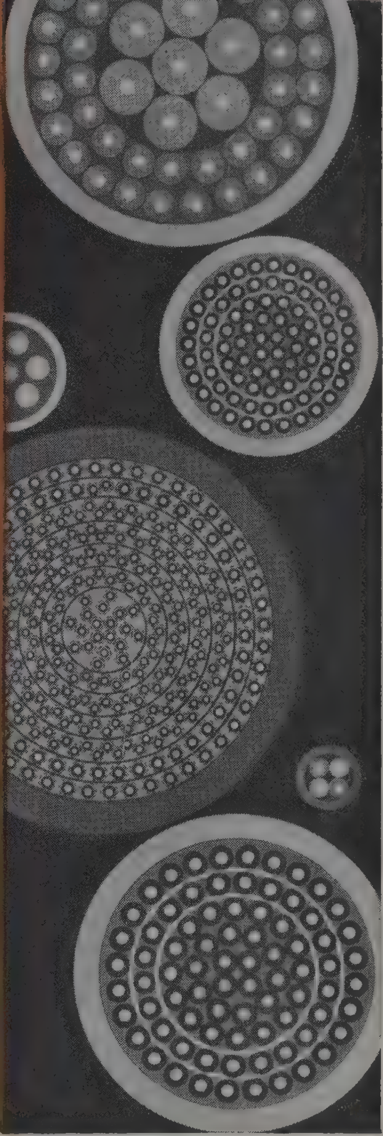


SPECIFICATION OR NAME OF PRODUCT
PERCENTAGE COMPARISON AGAINST RECOGNIZED STANDARD AT 100%

Compared to these standards, Kaiser Wire constructions earn Value Ratings as large as 767%—valid proof that the spark of quality is Kaiser Wire experience.

For details and Value Rating listings, ask your Kaiser Wire Distributor for free K/W Value Rating Bulletins, or write: Kaiser Wire, Room 844h, Kaiser Aluminum & Chemical Sales, Inc., Kaiser Center, 300 Lakeside Drive, Oakland 12, California.

KAISER ALUMINUM & CHEMICAL CORPORATION



KAISER INTERLOCKED ARMOR CABLE DISTRIBUTES POWER AT LOWER COST

It needs no conduit for protection. It is flexible, forms easily. And because of its light weight, K/W Aluminum Interlocked Armor Cable cuts installation costs. One hundred feet of this aluminum-armored cable in unshielded 5KV, 3-cdr, size 1/0 AWG, weighs only 125 lbs. compared to 234 lbs. for size 2, copper-conductor steel-armored. K/W aluminum-armored is corrosion resistant . . . and its insulation has nearly 20 times the ozone resistance required by IPCEA.

K/W ALUMINUM INTERLOCKED ARMOR CABLE

VALUE **363%** RATING

KAISER PORTABLE CORD SAVES $22.24 IN ONE TOOL'S REPAIRS

A typical case shows how K/W Master Laytex portable cord can save $22.24 in maintenance—before a single repair. A new length of K/W Master Laytex cost the buyer $4.65; plus an estimated $6.00 labor to connect it. An equal length of "bargain" cord (low-priced C.V.) cost $2.89. But the latter was in and out for repairs five times—running up $30.00 labor—before K/W Master Laytex failed once. The net saving was $22.24 with K/W Master Laytex cord.

K/W MASTER LAYTEX PORTABLE CORD

VALUE **308%** RATING

KAISER CONTROL CABLES OFFER WIDEST CHOICE OF INSULATIONS

Kaiser Wire offers the following broad range of control cable insulations . . . Thermoplastics: Polyethylene, Polyvinyl Chloride. Synthetic rubber: Pyrosec® (SBR), Hydrosec® (SBR), Oil base, Kalzone® (butyl), Silicone. Natural rubber: Kaiser Laytex®, the patented liquid latex covering unequalled for strength and dielectric qualities. Add neoprene or plastic jacketing, copper or aluminum conductor—and you can choose from hundreds of K W cables of extra value!

K/W LAYTEX-RESIN CONTROL CABLE

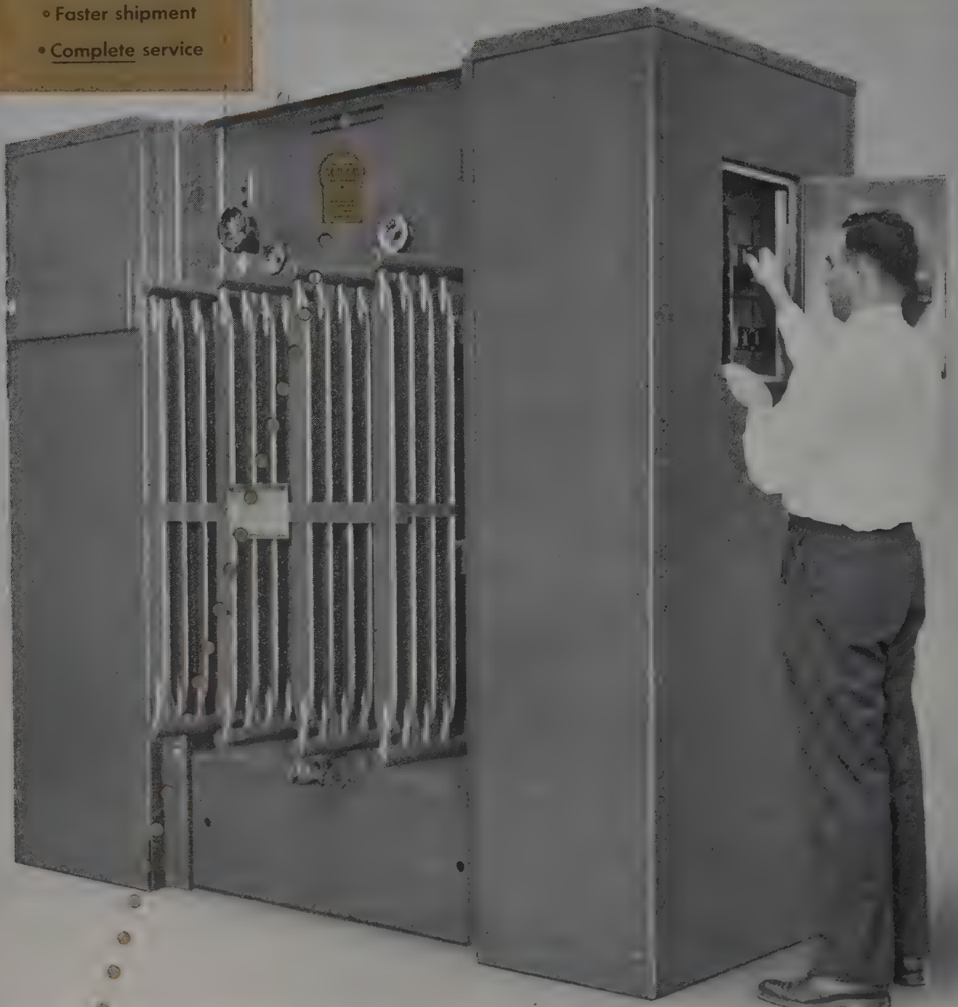
VALUE **767%** RATING

IN COPPER AND ALUMINUM CABLES . . . THE SPARK OF QUALITY IS KAISER WIRE EXPERIENCE! KAISER ALUMINUM

FULL-VALUE
CERTIFIED
TRANSFORMER
GENERAL ELECTRIC

- Superior design, features, and performance
- Faster shipment
- Complete service

NOW... a wider



SYMBOL OF FULL VALUE

With this seal, General Electric certifies full value for your transformer dollar; full value in terms of superior basic design, features, and performance . . . plus faster order handling and shipment . . . plus complete service before, during, and after installation. No other transformer manufacturer can match this complete General Electric package.

choice of power packages

General Electric offers efficient, co-ordinated Integral Distribution Centers for every load application

hatever your load requirements, General Elec- c offers an Integral Distribution Center that just right for the job. Five incoming, three ansforming, and five outgoing sections are avail- le to provide a versatile line of power packages any application. The result . . . a "customer- signed" combination saving you the cost of ecial design engineering.

And, since each Integral Distribution Center shipped in a *single,* pre-wired package*, instal- ion costs are lower.

Choose from over 50 power packages

General Electric offers more than 50 distribu- n-center combinations . . . with ratings from 2½ to 2500 kva. Here are the "building ocks" that make these combinations possible:

Five high-voltage terminations: air switches th stored-energy mechanism (2 types), oil- ed cutouts, liquid-filled switches, or a full-length ble-termination compartment.

Three transforming sections: liquid-filled (oil Pyranol†, 112½-2500 kva), open dry-type, or s-filled sealed dry-type (300-2500 kva).

Five low-voltage terminations: AK circuit eaker, full-length terminal compartment, olded-case circuit-breaker panelboard, fusible sconnect-switch panelboard, motor starters.

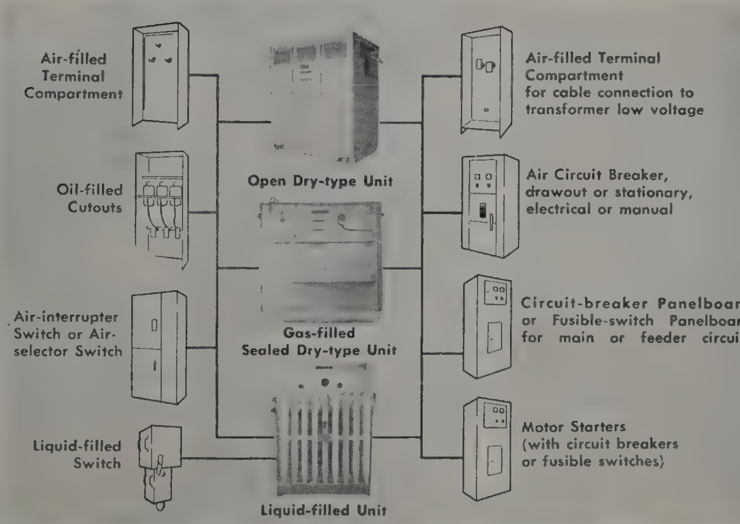
Optional features such as metering, relaying.

Space-saving size: newly redesigned packages ch as the compact 300- and 500-kva units can ve as much as 45% of the valuable space re- ired by earlier models.

For further information, call your General Elec- c Sales Engineer, or write for Bulletin GEA- 22, General Electric Co., Schenectady, N. Y.

r switches shipped separately 417-09

g. Trade-mark of General Electric Co.


Air-filled Terminal Compartment
Oil-filled Cutouts
Air-interrupter Switch or Air-selector Switch
Liquid-filled Switch
Open Dry-type Unit
Gas-filled Sealed Dry-type Unit
Liquid-filled Unit
Air-filled Terminal Compartment for cable connection to transformer low voltage
Air Circuit Breaker, drawout or stationary, electrical or manual
Circuit-breaker Panelboar or Fusible-switch Panelboar for main or feeder circui
Motor Starters (with circuit breakers or fusible switches)

WIDE VARIETY of combinations is possible because of the General Electric distribution-center "building blocks" illustrated here.

ALPHOLITE‡ INSULATION provides inorganic dielectric barrier for all dry-type units.

‡Trade-mark of General Electric Co.

STURDILY DESIGNED liquid-filled internal structure gives transforming section longer life.

Progress Is Our Most Important Product

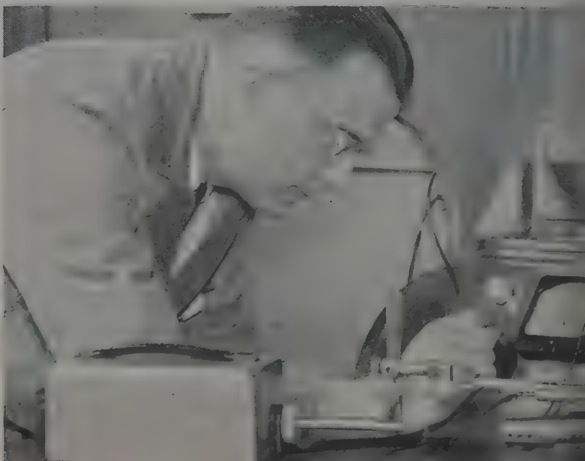
GENERAL ELECTRIC

Beefed up for hardest

Construction jobs are rough on generators . . . but not as tough as Onan's own tests. That's why Onan plants mean reduced downtime and maintenance. Over-sized bearings, Stellite valves, shorter, stronger crankshafts and connecting rods keep Onan on the job when others can't take it. Put an Onan on the job along-side the plants you're now using. Your own records will prove Onan best.

Stellite coated exhaust valves and valve seats. One of toughest alloys known. Gives you up to 300% longer valve life than uncoated valves. It's the important details like this that make Onan more economical in the long run.

Exacting standards govern manufacture—years of specialized experience and extensive testing facilities control the quality of Onan Power Plants. Over 1000 different types and sizes of plants are produced by Onan.



use...even abuse

Onan electric plant still delivers full power after 12,197 hour test—equal to 487,888 miles

A grueling endurance test that lasted one year, nine months and 12 days could not stop Onan test plant #1068. Onan engineers used this production-built unit for an endurance run—and after it was all over, it still generated the full rated power promised on the nameplate. Proof that Onan's exacting standards and production testing give you a power plant with long, dependable life built in.

Over 1,700 other endurance units have been run by Onan engineers. In these tests every design feature and part has to prove itself before it can become a part of the Onan you buy. In addition, every type and size Onan plant is tested under all operating conditions which could conceivably affect performance on your job.

Hours of running in and testing under full load are given *every* Onan before it is shipped. An independent testing laboratory then spot tests Onan Plants that have already been tested by Onan—double assurance that every Onan will deliver its full nameplate rating. Only then does an Onan production run qualify for Performance Certification.

Buy *proven performance* when you buy an Electric Plant. See your authorized Onan distributor or dealer. You can depend on him for a lifetime of factory parts and service. He's listed in the Yellow Pages.

ONLY ONAN GIVES YOU THIS CERTIFICATION

PERFORMANCE CERTIFIED

We certify that when properly installed and operated this Onan electric plant will deliver the full power and the voltage and frequency regulation promised by its nameplate and published specifications. This plant has undergone several hours of running-in and testing under realistic load conditions, in accordance with procedures certified by an independent testing laboratory.

World's Leading Builder of Electric Power Plants

ONAN DIVISION, STUDEBAKER-PACKARD CORPORATION • 2581 UNIVERSITY AVE. S. E., MINNEAPOLIS 14, MINNESOTA

HOTKOTE ®
CHICAGO
U.S.A.
UNDERWRITERS LABORATORIES, INC. INSPECTED
RIGID STEEL MPCONDUIT 61
CLAYTON MARK & CO.
GALVAKOTE
TRADE MARK
CHICAGO
U.S.A.
UNDERWRITERS LABORATORIES, INC. INSPECTED
L2 RIGID STEEL CONDUIT 92
CLAYTON MARK & CO.
ENAMELKOTE
TRADE MARK
CHICAGO
U.S.A.
UNDERWRITERS LABORATORIES, INC. INSPECTED
68 RIGID STEEL CONDUIT 15
CLAYTON MARK & CO.

FROM MANUFACTURERS OF CONDUIT SINCE 1910 . . .

HIGH QUALITY

RIGID STEEL CONDUIT

A TYPE TO MEET ALL REQUIREMENTS

HOTKOTE—Special, hot-galvanized exterior and interior surfaces provide bond with concrete and allow easy pulling of wires. Threads hot galvanized after threading to prevent rusting. U/L Approved and meets Fed. Spec. WWC 581c.

GALVAKOTE—Electro-plated exterior, including threads, prevents corrosion, assures long life. Interior surface evenly coated with baked-on enamel to provide smooth finish for easy "fishing". Will not flake or chip. U/L Approved and meets Fed. Spec. WWC 581c.

ENAMELKOTE—Both interior and exterior surfaces coated with high-grade, baked-on black enamel. Bends, cuts and threads easily without flaking. Accurately cut standard gauge threads. U/L Approved and meets Fed. Spec. WWC 571a.

And to complete the conduit line . . .

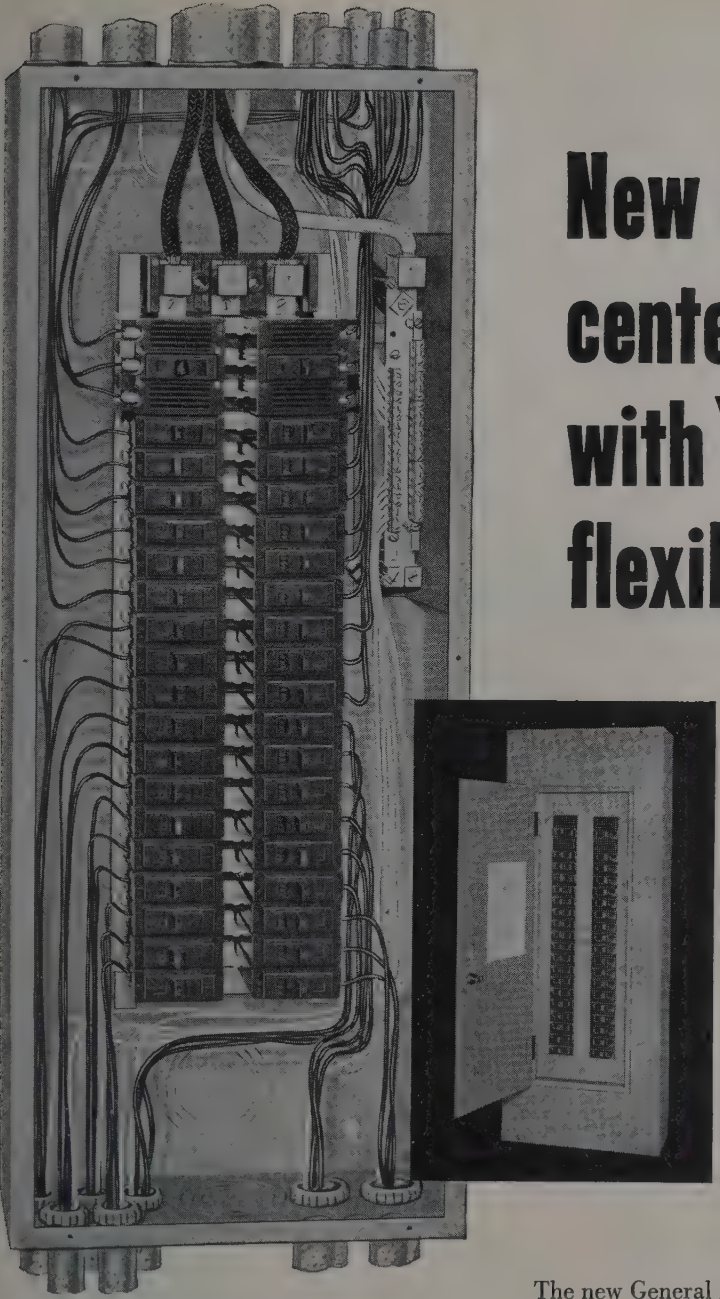
ELECTRICTUBE EMT—Satin-finish, close-grained, electro-galvanized EMT has exceptional corrosion-resistant life. Super-smooth interior surface permits easy fishing of wire. Bends easy . . . saves money on job. U/L Approved and meets Fed. Spec. WWT 806b.

ALUMINUM—Lightweight, corrosion-resistant, easy to bend and cut. Color-coded thread protectors. Cuts handling and labor costs. Conveniently packaged in 10′ lengths in all diameters. U/L Approved.

DISTRIBUTED IN ALL 50 STATES AND THROUGHOUT THE WORLD

CLAYTON MARK
& COMPANY
1903 DEMPSTER STREET · EVANSTON, ILLINOIS · U.S.A.

4540



New 3 phase load centers to 200 amps with "TWIN"* breaker flexibility

- Full line of 3-phase, 4-wire load centers . . . 12 to 42 circuits . . . 125, 150 and 200 amperes.
- Sequence phased for maximum versatility with "TWIN," 1-, 2-, and 3-pole breakers . . . meets NEC non-interchangeability requirement for breakers . . . U/L listed.
- Snap-out interior . . . empty box mounts fast, leaves plenty of room to pull in wires . . . reversible box and interior . . . extra wide gutters.
- Tumbler type locking kit available . . . sealing loops . . . lugs accept copper or aluminum wire.

Cat. No. TRP42-420S 200 amperes . . . 42 circuits

*Trade Mark

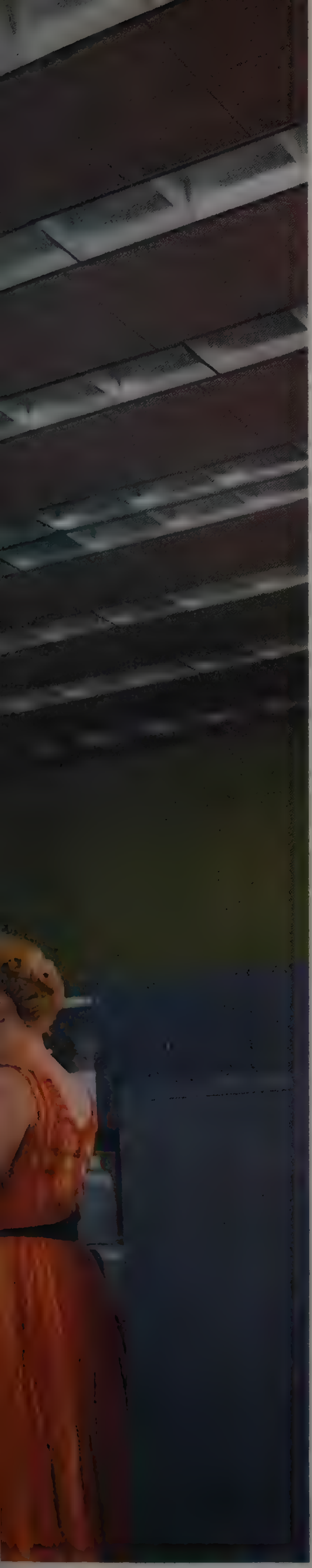
The new General Electric 3-phase load centers now provide the same time and cost saving features as the popular line of residential "TWIN" load centers. They're in stock now at your local G-E distributor, for either flush or surface mounting and in 12, 18, 24, 30 and 42 circuits to 200 amperes. 12 and 18 circuit models also available in raintight boxes.

For more information, write General Electric Company, Plainville, Conn. Ask for Bulletin GEA-7076.

GENERAL ELECTRIC

QHT* dry-type transformers

Wall-mounting of this compact QHT transformer provides bonus floor space for equipment and personnel.



Lighter, smaller General Electric QHT transformers give bonus floor space

The new General Electric QHT dry-type transformers save you production space because they offer savings up to 50 percent in weight and 67 percent in size compared with competitive dry-types. QHT units up to 75 kva have built-in provisions for wall mounting, and larger units can be set in out-of-the-way places near the load, saving the cost of long, low-voltage feeders.

A new insulation system permits use of smaller coils to reduce size and weight of QHT transformers. Inorganic silicone impregnated insulation is highly resistant to water, dust, and corrosive atmospheres. Also, aluminum conductors and cold-rolled, grain-oriented silicone steel combine to give you a smaller, lighter, quiet transformer designed for years of dependable service.

QHT dry-type transformers are easy to install. Units have conveniently placed, dual-sized knock-outs, large terminal compartments and wiring spaces. All wiring can be done from the front.

QHT transformers are quiet—at least 15 decibels quieter than older designs. All have sound levels equal to or less than NEMA standards.

You can get 24-hour delivery on most models from your nearby General Electric distributor. Call him for complete information, or write for GEA-6907A "QHT Specifier's and Buyer's Guide" to Section 411–16, General Electric Co., Schenectady 5, N. Y.

* Registered trademark of General Electric Company for quiet, high-temperature dry-type transformers.

Progress Is Our Most Important Product

GENERAL ELECTRIC

COMPARE . . . G-E Transformers are 32% to 67% smaller

	NEW QHT	TRANS. "A"†	TRANS. "B"†	TRANS. "C"†
45 KVA				
Height (in.)	26¼	41¼	30	32
Width (in.)	24	28⅝	31	22
Depth (in.)	19	26	19	28½
Weight (lbs)	430	780	790	500
Volume (cu. in.)	11,970	30,695	17,670	20,064
225 KVA				
Height (in.)	44¼	60	50	66¾
Width (in.)	41	54	56	55
Depth (in.)	24¾	30	28	37
Weight (lbs)	1500	2300	3000	2500
Volume (cu. in.)	44,902	97,200	78,400	135,836

† Transformers "A," "B," and "C" represent products of well-known transformer manufacturers. Data was taken from current published information.

Here is the tool that permanently anchors a duct strap to concrete with less than ten taps of a hammer. Without drilling or plugging.

It's called Shure-Set.®

It does plenty of other fastening jobs too. Junction boxes, conduit clips, gutters. Heaters, signs, Wiremold. Using Shure-Set you can attach almost anything to concrete and other masonry materials. And you do it rapidly.

How is it possible? A special steel fastener is inserted at one end of Shure-Set, your hammer blow is directed against the large movable anvil at the other end. The easy-to-hit anvil concentrates the force of the hammer blow onto the fastener, but within the confines of Shure-Set's precision bore. The fastener can't waver or skew off. Every swing of the hammer drives it straight and true into the concrete. (Note: powder charges are *not* used in this tool.)

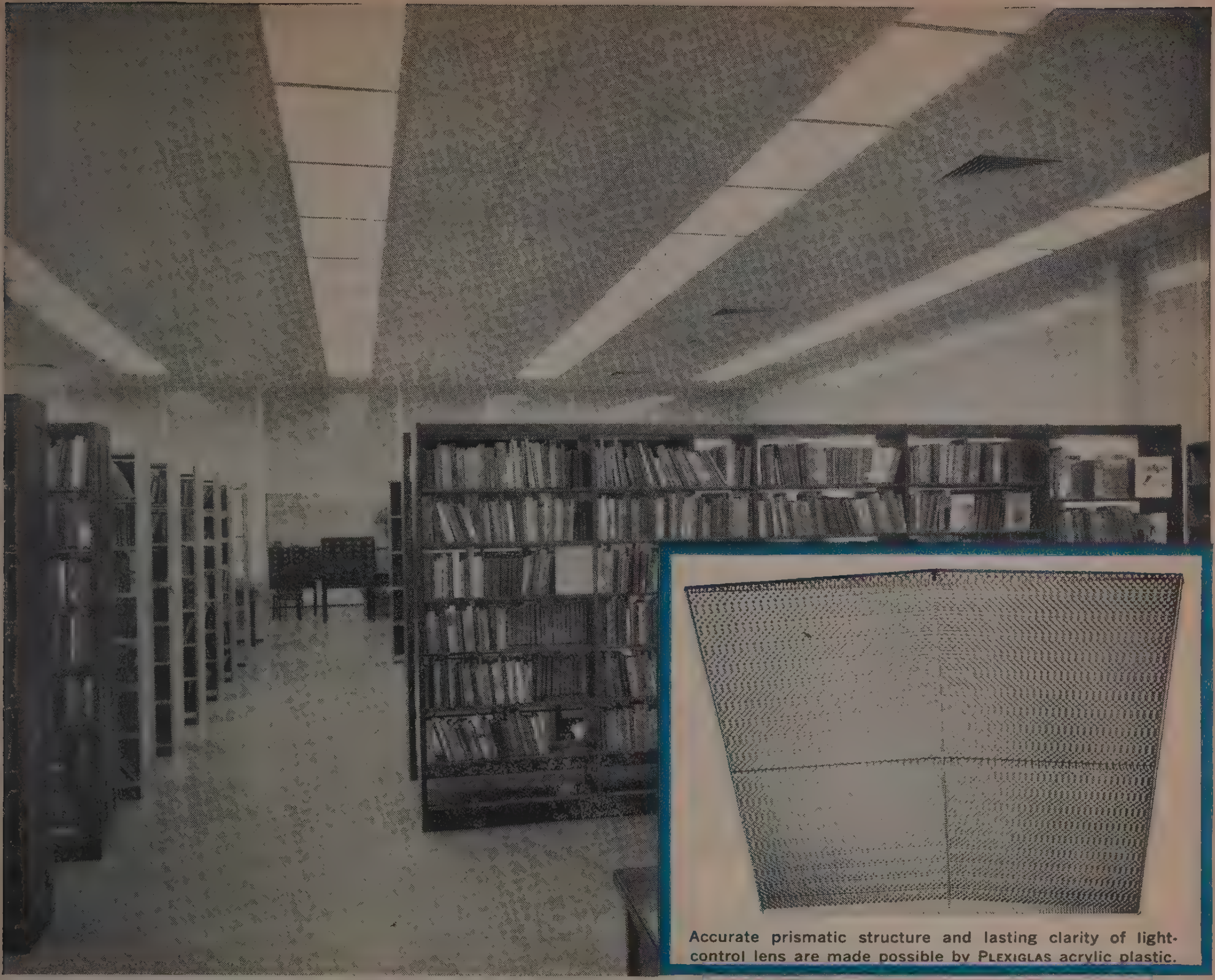
And Shure-Set's austempered steel fasteners *never* bend or break. Austempering has given them the ideal metallurgical properties for penetrating hard construction materials (it's the same heat treatment we give our *powder-driven* fasteners). These steel drive pins ("nails") and threaded studs make a strong, permanent, compressive bond to concrete. For a light-duty fastening, you won't find anything stronger.

And for the few cases—such as tile or glazed brick—where "tap-and-turn" work is unavoidable, a drill holder attachment is provided for converting Shure-Set into a superior masonry drill. Still another attachment fits it for use in fastening sheet metal to sheet metal.

Shure-Set is on its way to becoming a tool box standard because of its immense versatility. And because it pays for itself by saving time. Usually on the very first job. It also saves a lot of (put your own price on it) perspiration.

To find out where to buy Shure-Set nearest you, look under TOOLS in the Yellow Pages of your directory.

285-I Winchester Ave., New Haven 4, Conn. WINCHESTER-WESTERN DIVISION Olin



Accurate prismatic structure and lasting clarity of light-control lens are made possible by PLEXIGLAS acrylic plastic.

Control lenses molded of PLEXIGLAS mounted in continuous rows in library of County of Sonoma school administration building, Santa Rosa, California. Architects: Steel & Van Dyke, Santa Rosa.

Plexiglas...for lighting that stands out and stands up

When lighting equipment includes control lenses molded of PLEXIGLAS® acrylic plastic, the result is illumination of the highest quality. This is because PLEXIGLAS makes possible a precisely designed optical element that directs light to the area where it is required and, at the same time, minimizes the surface brightness of the lens as seen from normal viewing angles.

In addition, lenses of PLEXIGLAS remain free of discoloration even after years of exposure to fluorescent light. They are strong and rigid yet light in weight, resulting in safety overhead and ease of maintenance. And the crystal clarity of PLEXIGLAS assures full utilization of light.

Full details on the use of PLEXIGLAS as a lighting material are contained in our 40-page technical bulletin "PLEXIGLAS for Lighting". We will be glad to send you a copy.

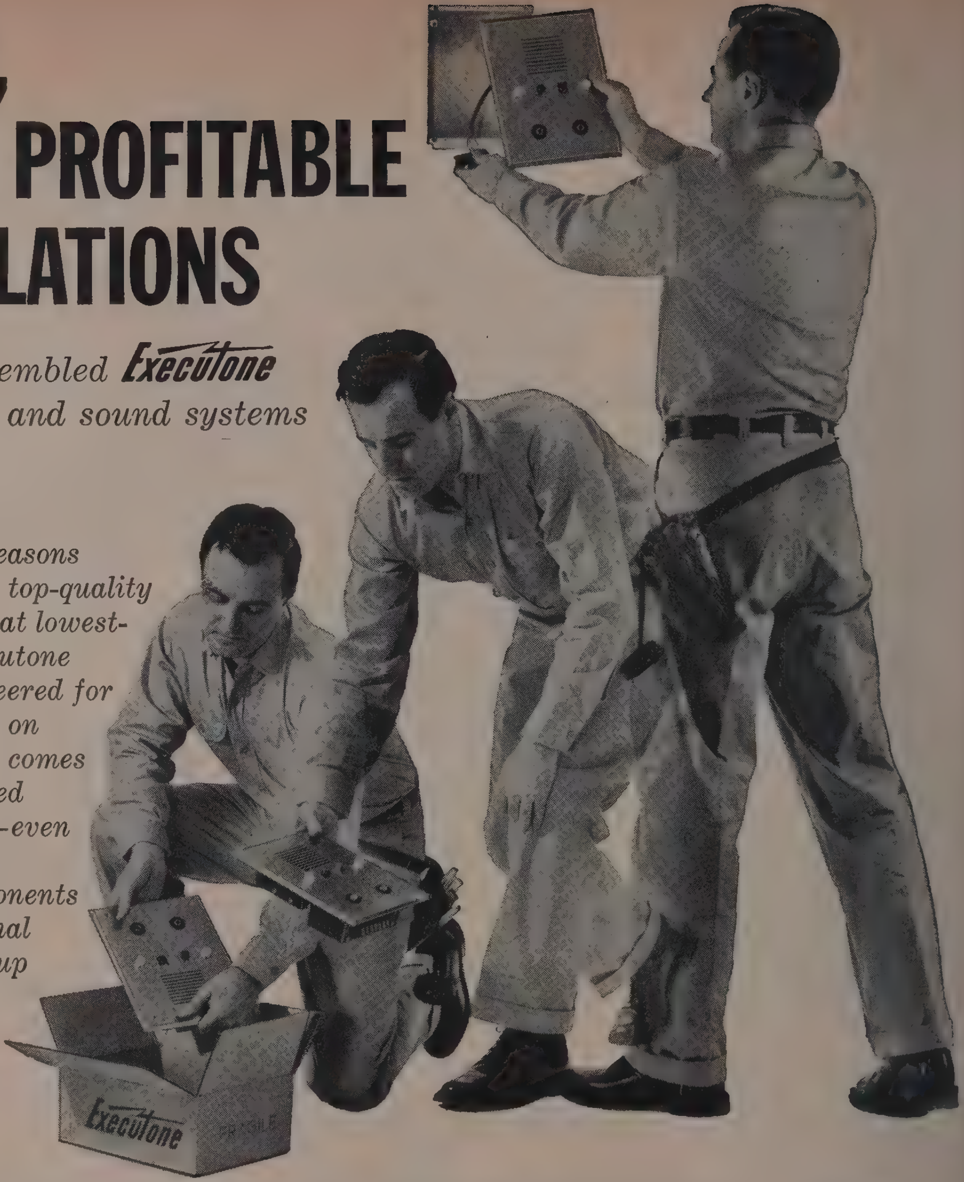
ROHM & HAAS
PHILADELPHIA 5, PA.

In Canada: *Rohm & Haas Co. of Canada, Ltd., West Hill, Ontario*

PLEXIGLAS

FASTER, MORE PROFITABLE INSTALLATIONS

with factory-assembled **Executone**
intercom and sound systems



Here's one of five reasons why you can put in top-quality Executone systems at lowest-installed-cost. Executone equipment is engineered for least assembly time on the job. Every unit comes completely assembled and factory-tested—even consoles, racks and reproducers. Components have plug-in terminal blocks, to cut hook-up time to a bare minimum. Check these other profit-building Executone Extras:

- **EXPERT PRE-PLANNING:** assistance in system layout, preparation of bids and estimates.
- **COMPLETELY ENGINEERED SYSTEMS** from one source—even including special color-coded wire.
- **INSTALLATION SUPERVISION** helps you finish fast . . . assures proper hook-up, adjustment, check-out.
- **NO SERVICE CALL-BACKS** because Executone takes full, immediate responsibility for operation of the system.

Start building profits the Executone way. Check the coupon below for information on Executone sound and communication equipment for selected building types. We'll also send you a convenient Conduit Selection Chart to help you cut costs in layout and installation.

Executone
COMMUNICATION AND SOUND SYSTEMS

Executone, Inc., 415 Lexington Ave., Dept. F-12, New York 17, N. Y.
Send me your Conduit, Wire and Cable Chart. Also: information on Executone equipment for
☐ schools ☐ hospitals ☐ offices ☐ plants ☐ retail stores ☐ homes ☐ other______
Name______________________________
Company______________________________
Address______________________________
City________________Zone______State__________
In Canada: 331 Bartlett Avenue, Toronto

IDEAL **WIRE-NUT**®
WIRE CONNECTOR

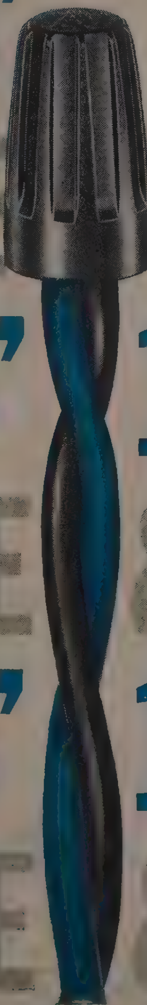
Builders' First Choice -- Here's Why . . .

The Wire-Nut success story is really quite easy to explain. Wire-Nut is the first choice of more contractors and electricians everywhere because Wire-Nut is so *safe,* so *sure,* so *simple!* Perhaps it just sums up as *dependability*. Since 1928 (when Ideal introduced Wire-Nut as the first successful screw-on wire connector) electrical men have come to depend on Wire-Nuts. They are the proven safe connectors that splice with a shake-proof, wire-crushing grip. U.L. has approved Wire-Nuts for every normal solid and/or stranded wire combination. And Wire-Nut screws on any wire combination with a simple twist of the wrist, to make the strongest, most permanent wire joint known. FREE CATALOG. Write today for your free copy of the new Ideal Contractor Catalog.

Sold through America's leading distributors • In Canada: Irving Smith, Ltd., Montreal

IDEAL INDUSTRIES, Inc., 1041-1 Park Avenue, Sycamore, Illinois

IDEAL the helping hand on every wiring job.



BUILDERS' 1st CHOICE
SAFE, SURE & SIMPLE
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©1961 VOLKSWAGEN OF AMERICA, INC. *SUGGESTED RETAIL PRICE EAST COAST P.O.E.; $2,015 WEST COAST

What does it cost after you pay for it?

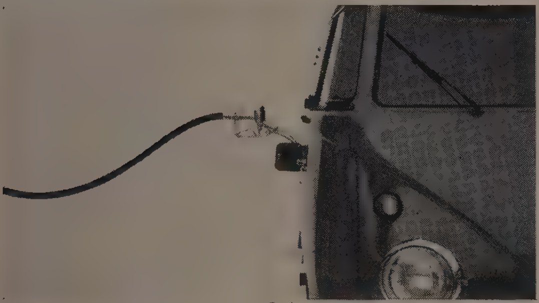
The $1,895* we charge for a Volkswagen Truck is only the beginning.

The cost goes up every time you buy gas.

Or tires. Or oil. Or parts.

But.

This isn't the only truck that runs on gas, oil and tires.



VW trucks average 24 mpg, regular gas.

In fact, some VW owners say our trucks use only half the gas their former trucks did.

Drivers doing 24,000 miles a year often tell us their VW took only $400 worth of gas.

Where their former trucks took $800.

It doesn't surprise us. The efficiency of our magnesium-aluminum engine is a legend. Almost all VW trucks get over 20 miles a gallon. Some get 30.

Our average is 24.

This is due to the elimination of dead weight. The whole truck weighs only 2,282 lbs. A loaded VW is almost as light on its feet as a conventional truck empty.

This also means less weight on tires. Most trucks in our class get about 20,000 miles on a set. We get 35,000. Sometimes 40,000.

You save another $100 there. Every time around.

Volkswagen engines almost never need oil between changes. And never need anti-freeze at all. They're air-cooled. No water to freeze up in winter or boil over in July.

Service? Owners tell us they put only half the money into VWs that they put into maintaining their old trucks.

After all, we've made the same basic model for 12 years now. We've improved almost everything in it. And then improved most of the improvements.

(We try to make parts for new VWs fit old ones, too. Our spares are often better than the parts your VW came with in the first place.)

Deliver next to nothing and still make a profit.

Now then.

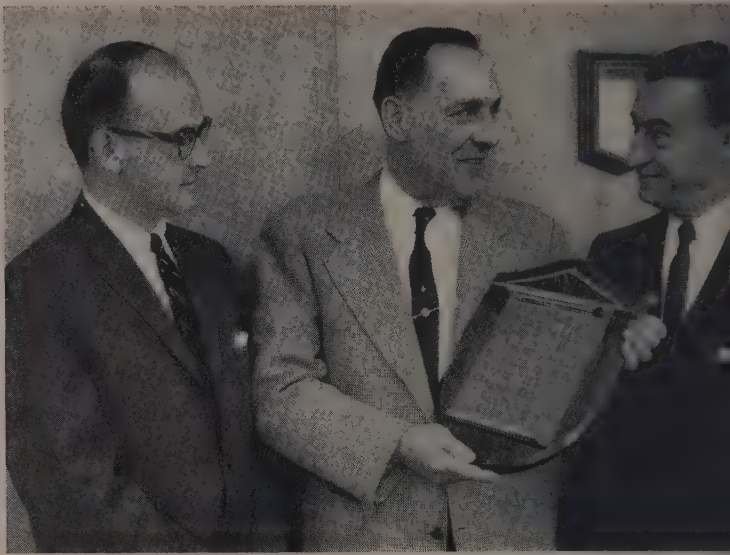
Taking just gas and tires, the man who saves $450 a year will save $1,350 in 3 years—the time many owners take to finance a new truck.

Does this mean the Volkswagen costs only $545?

Can that be?

Jack Kenny Wins LOOK Contractor Award for residential wiring promotion

Uses Murray GUARANTEED FOR LIFE Sales Aids to Help Boost Rewiring Sales



Jack Kenny is being congratulated by Jack Catherwood of Long Island Lighting Co., Chairman of Residential Task Group, National Wiring Bureau and Al Palumbo, Long Island salesman for Murray Manufacturing Corp. on winning a LOOK award.

"For outstanding performance among electrical contractors in promoting residential wiring."

So reads the citation presented by LOOK magazine to Jack Kenny, President of K. J. Kenny, electrical contractors in Mineola, N. Y. Jack's promotional efforts to alert home owners to the need for adequate wiring to handle today's appliance loads paid off in increased sales.

The successful formula used by Jack Kenny was "Survey . . . Sell . . . and Satisfy." Find out which homes are still using low amp service; sell the homeowner through informative, hard-hitting direct mail and personal follow up; then satisfy him with a sound, high quality installation.

The "satisfier" used by Jack Kenny was Murray's guaranteed for life, MP fully magnetic circuit breakers. The Murray GFL Certificate presented to the homeowner, when the installation was completed, convinced him that he had made a wise decision . . . and a satisfied customer is still the best advertisement for an electrical contractor.

Murray promotional literature, particularly our popular consumer stuffer, played an important part in helping Jack Kenny sell adequate wiring to his many prospects.

Why not find out how you can cash in on the Murray Guaranteed for Life promotion program to build business, profits and prestige. See your Murray wholesaler today, or write directly to our GFL Merchandising Dep't.

m Murray

MURRAY MANUFACTURING CORPORATION
1250 Atlantic Ave., Brooklyn 16, N.Y.

Survey: Dave Edwards makes periodic survey of homes with 30 amp service to build prospect list.

Sell: Frequent direct mailing of Murray GFL promotion material to prospective customers sells them on the benefits of adequate wiring.

Satisfy: Al Northup, right, is pleased with his new load center with Murray's "Guaranteed for Life" circuit breakers.

FOR ALL CONTROL CABLE NEEDS
. . . SPECIFY SIMPLEX CABLE

RUBBER, PVC, SILICONE, POLYETHYLENE-NYLON, POLYETHYLENE-PVC, POLYETHYLENE, TEFLON

You name the requirement: supervisory cable for monitoring and/or recording; cable for protective devices, for heavy magnetic trip or break devices; control cable for use in conjunction with high voltage power circuits. Simplex will supply it . . . engineered precisely to specifications.

Simplex control cable insulations include rubber (Anhydrex, Anhydrex XX), PVC, Polyethylene, Polyethylene-Nylon, Polyethylene-PVC, Silicone and Teflon. And they meet all IPCEA-NEMA standards.

Simplex cables are available with copper, bronze, aluminum and steel C-L-X sheaths or with a variety of other jacketing materials. Also available are packaged combinations for power and control.

Simplex welcomes the opportunity of discussing individual control and power cable problems. Write today, giving details.

Simplex
WIRE & CABLE CO.
Cambridge, Mass. • Portsmouth, N. H.

Sylvania's HQ Fixture
provides
NORGE Division
of Borg-Warner
QUALITY Lighting
ECONOMICALLY

The Norge Division of Borg-Warner Corporation in Effingham, Illinois, faced a common problem. They wanted better lighting in their office and drafting room . . . to eliminate shadows and glare . . . to make seeing easier . . . to enable engineers to perform their critical work without cumbersome auxiliary lighting equipment. And they wanted this new illumination system at reasonable cost.

The happy solution—Sylvania's HQ Series fixtures using 1500 ma (VHO) lamps, together with a newly-painted ceiling area. These indirect fixtures with 75% upward component provide 120 footcandles (measured) of well-diffused quality illumination. Glare and shadows are non-existent. The need for supplementary lighting equipment has been eliminated.

Sylvania's fixtures met the final requirement, too. This system of HQ Fixtures cost considerably less than other systems that had been suggested.

The installation at Norge is another example of how, with Sylvania Fixtures, you can choose the lighting fixtures that fit the requirements of *your* job. No *one* fixture meets the requirements of *all* installations. But with Sylvania's fixture line, you can choose the lighting that fits your needs best. And you'll get top-flight performance from every one.

When you want better lighting . . . look into the many advantages that Sylvania offers.

SYLVANIA LIGHTING PRODUCTS
A Division of SYLVANIA ELECTRIC PRODUCTS INC.
One 48th Street, Wheeling, West Virginia

LIGHTING FIXTURES BY

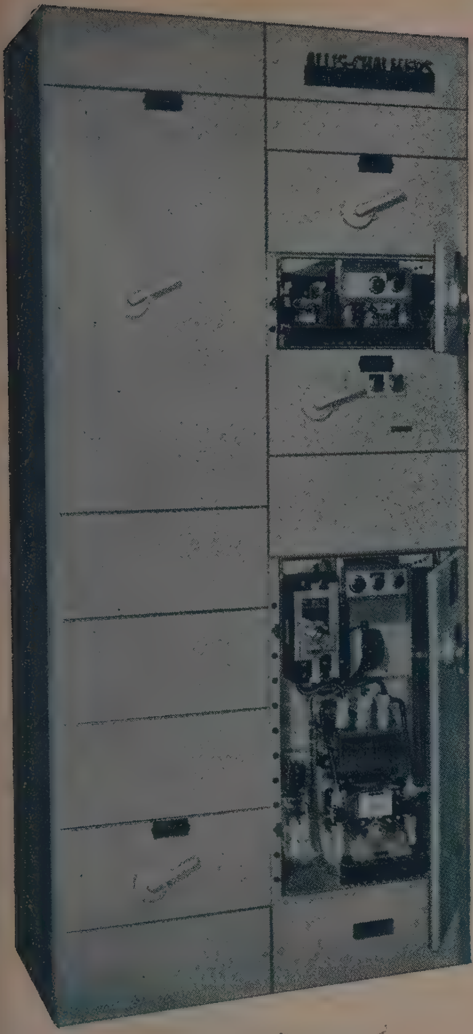
SYLVANIA

SUBSIDIARY OF

GENERAL TELEPHONE & ELECTRONICS

GENERAL
SYSTEM

ALLIS-CHALMERS



1. Centralized control saves space, cuts installation and engineering costs.

2. Exclusive plug-in terminal blocks permit removal of units without tools. Fully accessible location at front of units simplifies your wiring.

3. Extra heavy plug-in stabs and positive alignment provided by TRACK-GUIDE drawout mechanism assure trouble-free electrical connection.

4. With TRACK-GUIDE mechanism, units can be easily and safely de-energized and locked out, or withdrawn from enclosure for inspection and maintenance.

5. Units can be tilted up for inspection of stabs without removing from TRACK-GUIDE mechanism, or fully removed for bench maintenance or interchange.

...six reasons why Allis-Chalmers new motor control center design is

the center of satisfaction

Satisfaction? It comes with every one of the new (yet fully proven) low-voltage control centers from A-C. Their clean lean design saves valuable space. Exclusive plug-in terminal blocks cut installation time . . . speed inspection and removal. *Track-Guide* drawout mechanism lowers maintenance costs. Control units can be drawn out, tilted up, or completely removed without tools.

Safety features of these new control centers provide *sure* protection to personnel. Units can be quickly de-energized for maintenance or inspection work. Units cannot accidentally fall out of *Track-Guide* mechanism during inspection or maintenance.

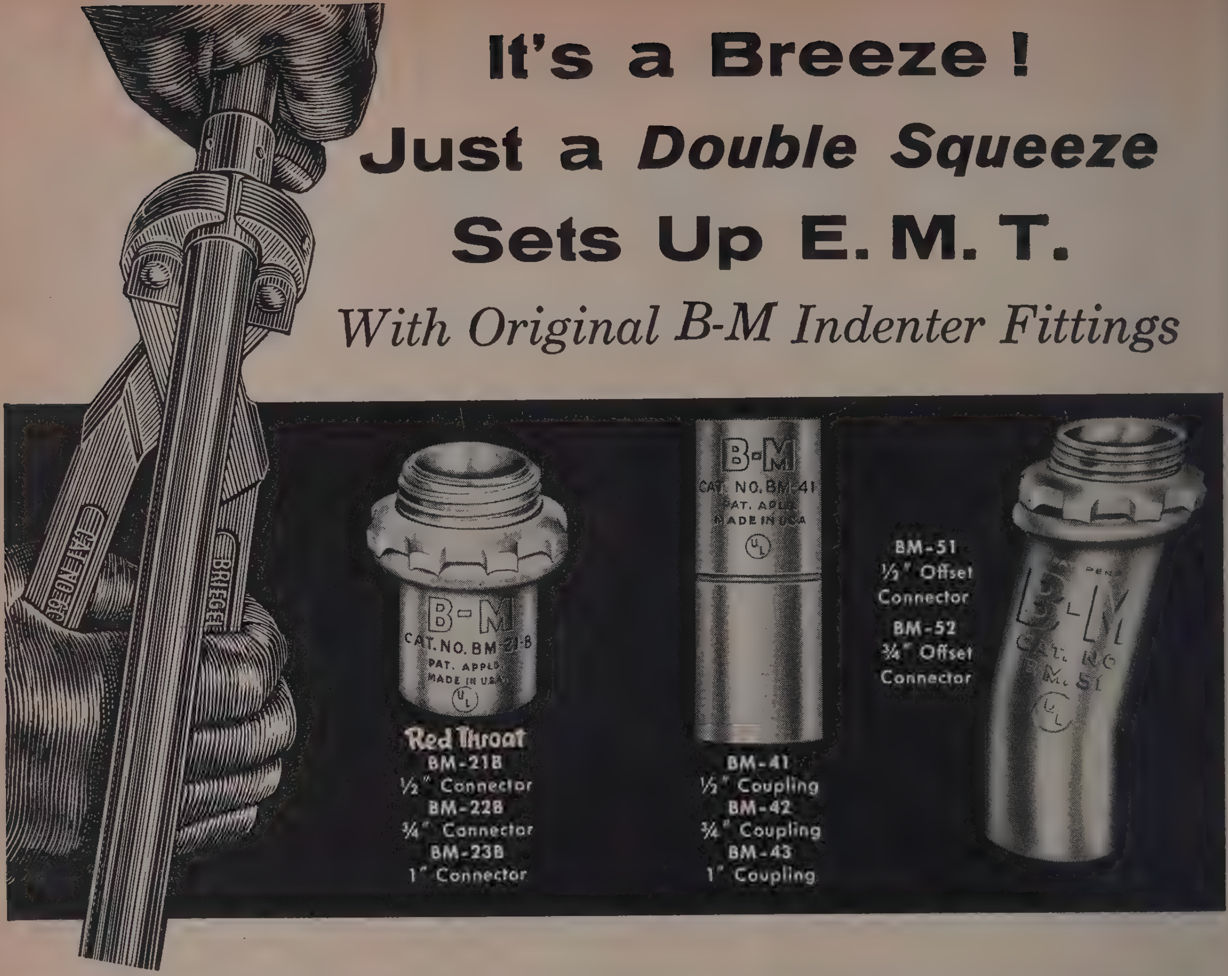
Reliability . . . versatility . . . economy . . . strength . . . safety. You name the feature — A-C motor control centers have it. *Ask your A-C representative or distributor for all the facts. Or write* **Allis-Chalmers,** *Industrial Equipment Division, Milwaukee 1, Wis.*

Track-Guide is an Allis-Chalmers trademark. A-1486

6. Mounting of pilot lights and pushbuttons on the removable control units eliminates failures common with hinged wiring.

It's a Breeze! Just a *Double Squeeze* Sets Up E. M. T.

With Original B-M Indenter Fittings

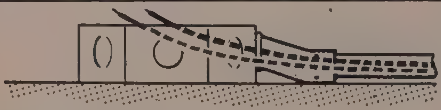


Red Throat
BM-21B
½" Connector
BM-22B
¾" Connector
BM-23B
1" Connector

BM-41
½" Coupling
BM-42
¾" Coupling
BM-43
1" Coupling

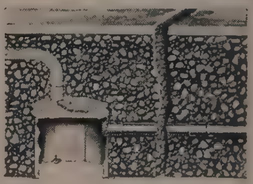
BM-51
½" Offset
Connector
BM-52
¾" Offset
Connector

B-M Indenter Fittings and Tools make an unbeatable combination when it comes to easier E.M.T. installation at less cost. New lightweight plier size indenters make setting up thin wall conduit a breeze. B-M fittings are neater too! No unsightly nuts or projecting set screws. Other plus features of B-M fittings are Concrete tight—Vibration resistant—Extra heavy bright zinc plate, salt spray and acid drip tested for corrosion resistance—Extra heavy positive bonding locknuts—Smooth rounded edges or bushed throat type connectors that prevent insulation damage—All steel construction with extra heavy gauge wall thickness.



B-M Offset Connector, showing how wires are guided over box edge.

Briegel All Steel Indenter Fittings are U.L. approved as Concrete-Tight.



BRIEGEL METHOD TOOL CO.

GALVA, ILLINOIS

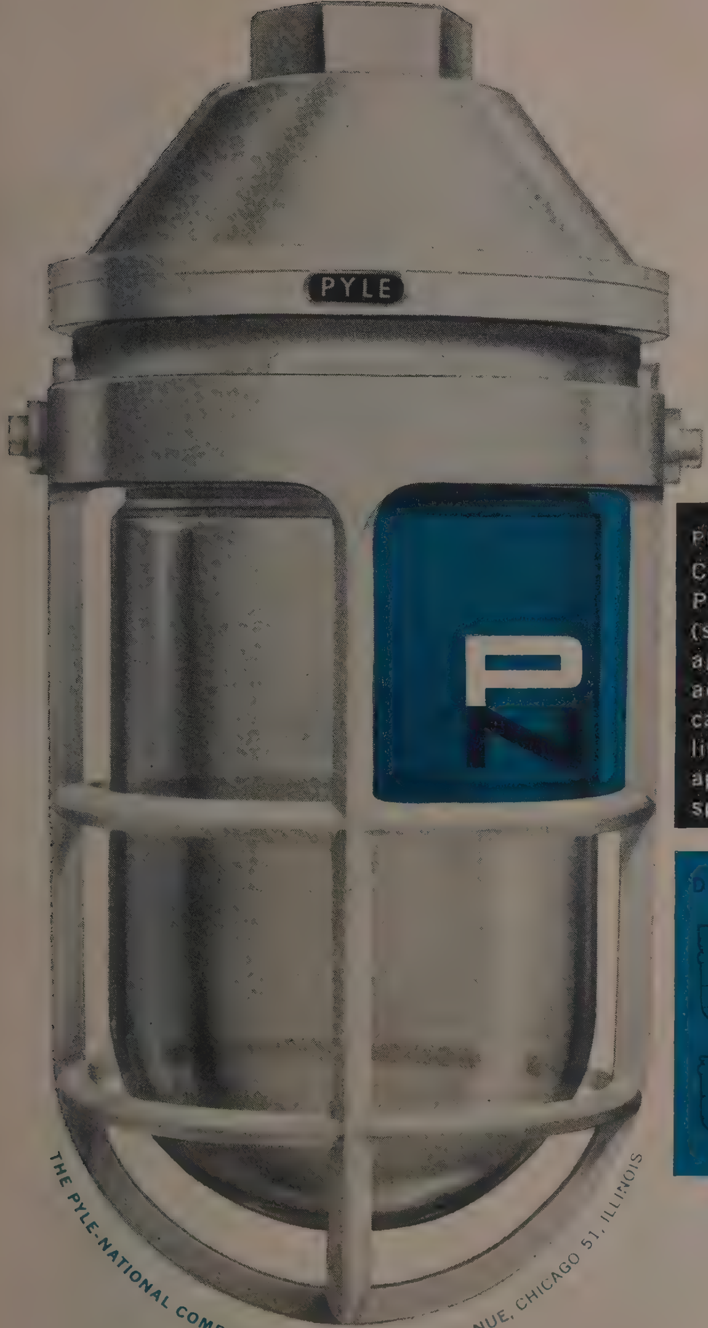
All B-M indenter type fittings far exceed the requirements of U. L. file card E 10863 and Federal Specifications W-F-406.

TELESCOPE BM SYSTEM

UL

USED THE MOST FROM COAST TO COAST

PYLE VAPORTIGHT LIGHTING FIXTURES



THE PYLE-NATIONAL COMPANY 1344 N. KOSTNER AVENUE, CHICAGO 51, ILLINOIS

NO TOOLS REQUIRED

Stainless steel ball detents allow for snap on and off of guard for easy lamp removal. Reflectors are removable by a 45° turn for convenient cleaning and have four self locking nylon shoes.

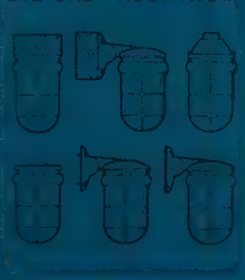
PEC-9 EPOXY FINISH

Corrosion-resistant PEC-9 white coating (standard) protects against salt spray, acid fumes, strong caustics and organic liquids. Eliminates application in field of special compounds.

INTERCHANGEABILITY

The interchangeable straight and 90 degree bracket mounting adapters fit both 100 watt and 200 watt fixture sizes. This allows for better inventory control and easy interchange in the field.

DIE CAST ALUMINUM



ADDITIONAL FEATURES

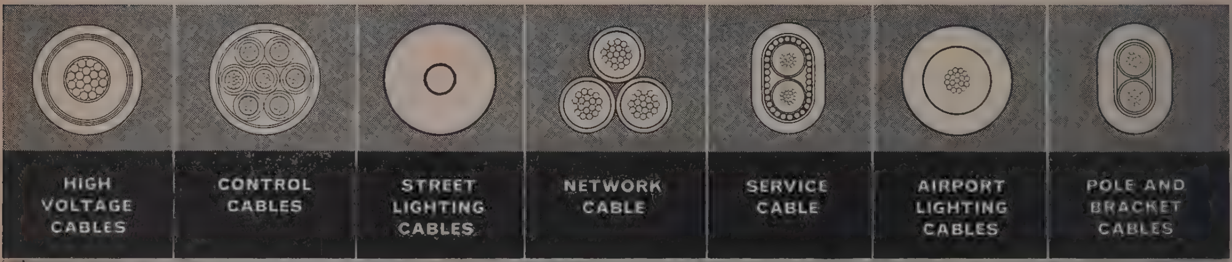
Heat resistant globes are standard in a choice of colors. Specification grade porcelain lamp grip socket and all white porcelain enameled reflectors. Lamp holder gasket seals off wiring and lamp compartments. All gaskets are exclusively oil resistant nitrile rubber-asbestos compound and are heat resistant up to 800°F. Fixtures are UL listed and meet Navy, Corps of Engineers and General Service Administration specs.

Sold nationally through authorized distributors   Also manufactured in Canada by: Pyle-National (Canada) Ltd., Toronto, Ontario

When dependability
is of vital nature
...a natural selection
is proven-quality

The consistent selection of Paranite by Power Users in all parts of the country is significant of its dependability. Producing reliable, high-quality power cable has been a Paranite specialty for 71 years... from 600 volt network through 28,000 volt power cable. You can depend upon it... "If it's Paranite, it's right.®"

PARANITE® POWER CABLE

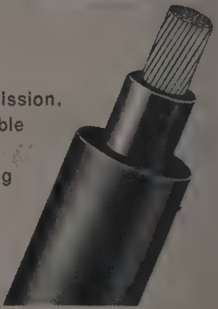


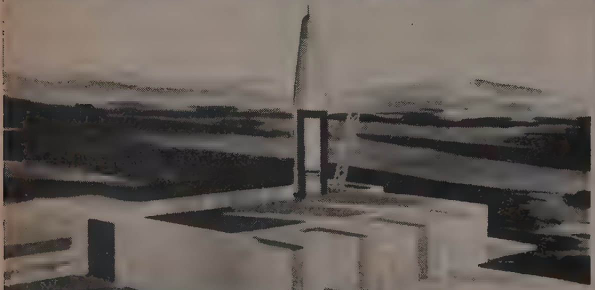
The Enrico Fermi Atomic Power Plant

near Monroe, Michigan, operated by the Power Reactor Development Company and the Detroit Edison Company. Paranite was selected to supply 600 V. network and 5,000 V. shielded cable for the nuclear section. Illustrated at right is a typical Paranite Power Cable.

Indian River Generator Plant

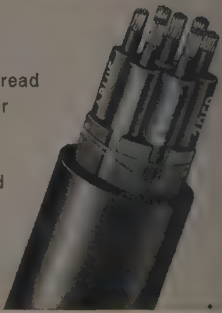
of the Orlando, Florida, Utilities Commission. From transmission line... to power cable ... through control cable... Paranite was specified to carry the load in serving this growing area. Illustrated at right is one of Paranite's complete line of 600 V. Network Cable.





Missile Bases

provide another example of the widespread and diversified use of Paranite in power distribution throughout the nation. Paranite Control Cables are produced in a complete range of insulation and jacket types. Illustrated at right is a typical Paranite Control Cable.



For more information on high voltage, control, street lighting, network, service and airport cables contact your local Paranite representative... or write Paranite Wire and Cable Division, Dept. 204, 2601 S. Adams St., Marion, Indiana.

Since 1890
PARANITE WIRE & CABLE DIVISION
ESSEX WIRE CORPORATION, Marion, Indiana
MANUFACTURING PLANTS: Marion, Ind.; Jonesboro, Ind.; Tiffin, Ohio; Anaheim, Calif.
Sales Offices and Redistribution Warehouses in all Principal Cities

How to determine proper Control Run for Remote Control Switches

With remote control switches (as with any electromagnetically operated device), it is absolutely essential that maximum allowable run for each switch should not be exceeded.

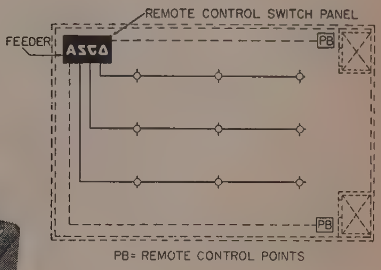
Here is a handy guide to help you determine admissible distances between switch and remotely located control station:

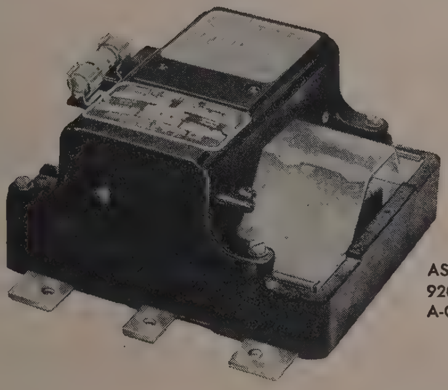
1. Doubling the control voltage will increase the allowable run with the same size of wire by about 4 times.
2. Doubling the cross sectional area of the control conductors will increase the allowable control run by 2 times. The cross sectional area of a conductor will approximately double with three gauge number sizes larger wire. Thus #14 has approximately double the area of #17, and one-half the resistance per unit length.
3. Full consideration should be given to the use of auxiliary relay control for remote control switches, particularly for group installations requiring master control and for extremely long runs.

The following tabular data specify maximum distance between control station and one Bulletin 920 switch with source line voltage at 90% of normal. Similar charts are available on the range of ASCO "remotes."

AMPERES	B&S GAUGE	DISTANCE IN FEET 110 V. 60 CYS.	DISTANCE IN FEET 220 V. 60 CYS.*
30,60,75	14	550	1600
	12	900	2600
	10	1400	4200
100,150,200	14	325	1200
	12	500	1900
	10	800	3000

*For 208 volt system, reduce 220 volt values by 30%.





ASCO 3-pole, remote control switch, Bulletin 920, is UL approved to 200 amps A-C, 600 v A-C, 250 v D-C.

Why Mechanically Held

A remote control switch is essentially a feeder disconnect switch. Consequently, it is usually installed in a lighting or power distribution panel feeding numerous circuits. In function the disconnect switch used should operate just like the manually operated type of disconnect switch—it should be unaffected by line voltage conditions and should respond only to the control of the push buttons.

Only a mechanically held switch can meet these requirements. Magnetically held contactors, which open on momentary line voltage dips and control circuit derangements, introduce the hazard of complete outage on vital circuits until repairs can be made.

ASCO Mechanically Held Remote Control Switches are unaffected by line voltage conditions; each switch includes a manual operating knob or handle so that the switches can be operated manually at any time.

The values for control run listed are for one switch. For installations involving more than one remote control switch connected to the same control conductors, the values listed can be considered as switch-feet. The allowable run for group installations will be equal to the listed values divided by the number of remote control switches operating from the same control conductors. Thus, if one switch has an allowable run of 100 feet with #14 wire, ten switches will be limited to 10 feet. When switches are located along a transmission control line, calculations in terms of switch-feet will produce the solution.

Dependable control by ASCO

New catalog 57-S2 on ASCO Remote Control Switches is now available. Write today for this basic reference on dependable electromagnetic control.

ASCO Electromagnetic Control ASCO

DEPENDABLE CONTROL BY Automatic Switch Co. 50J HANOVER RD., FLORHAM PARK, N. J. • FRONTIER 7-4600 • *AUTOMATIC TRANSFER SWITCHES • SOLENOID VALVES • ELECTROMAGNETIC CONTROL*

This marker frees one man from tracing cables

The Amprobe Cable Tracer* enables you—by yourself—to trace ten uncoded circuits simultaneously ten times faster than any other method. Simply plug one end of the conductors to be traced into the markers (there are ten of them), the other ends, in pairs, into the pocket-sized Cable Tracer, press the button, and a number lights up to provide unmistakable identification. See your distributor or write today for more details.

Here are some typical, broad category applications:
■ Trace commercial and residential conduit wiring. ■ Identify circuits in intercom and p.a. equipment. ■ Trace multi-conductor cables in control circuits. ■ Correct errors in labeling on panel boxes. ■ Test for opens and shorts. *$39.50 (higher outside U. S.).

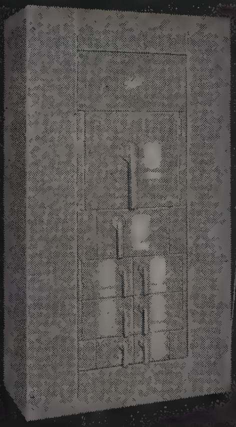
AMPROBE INSTRUMENT CORP.
LYNBROOK, NEW YORK
IN CANADA: ATLAS RADIO CORP., 50 WINGOLD AVE., TORONTO

FRANK ADAM ELECTRICAL EQUIPMENT

The Industry's Best Buy In Safety, Performance, Durability

LIGHTING PANELBOARDS

Plug-In or Bolt-On Circuit Breaker Types.



S-A-W DISTRIBUTION PANELBOARDS

Last Word in Heavy Duty Fusible Protection.

POWER PLUGIN BUSDUCT

Plug-In Outlets 10" Centers. 250/1500 Amps., 600-V. AC

MIDGET BUSDUCT

Extends Busduct System for Less Than Wire, Cable and Labor Costs. 100 Amps. Unfused, Fusible or Breaker Plug-In Units.

NON-COMBINATION

Starter and Fusible Switch Assembled.

COMBINATION

Single Enclosure With Starter and Switch or Starter and Breaker

PLUG-IN MOTOR STARTER UNITS

Plugs into Panelboards or Switchboards. Eliminates Separate Motor Controls.

No matter what the size and complexity of the project—no matter if the need is for the largest switchboard or the smallest safety switch—the Frank Adam name upon it is a warranty of unsurpassed quality and craftsmanship, protection and durability.

Give your clients every benefit in safety, dependability and economy of the "industry's finest"—specify, insist on, Frank Adam Electrical Equipment.

Write for catalog literature

FRANK ADAM ELECTRIC COMPANY

SINCE 1891

P. O. BOX 357, MAIN P. O. • ST. LOUIS 66, MO.

busduct • panelboards • switchboards • service equipment • safety switches • load centers • Quikheter

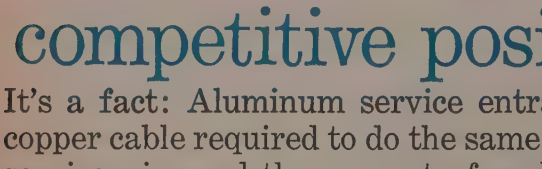
KEEP PACE ELECTRICALLY

AFFILIATED WITH THE PRODUCERS COUNCIL AMERICAN INSTITUTE OF ARCHITECTS

MAKE THE CHANGE AND COUNT YOUR SAVINGS

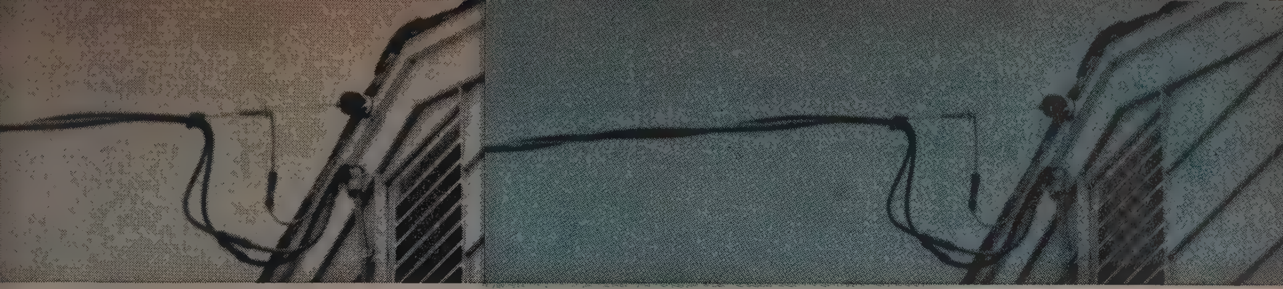
See how the switch from copper to Rome's *aluminum* service entrance cable can improve your competitive position.

It's a fact: Aluminum service entrance cable usually costs less than copper cable required to do the same job. Just how much less depends on service, size and the amount of each kind of cable you use. Check the tables on the right and compare the difference between the cost of copper and the equivalent in Rome's aluminum service entrance cable. Then multiply the difference by your requirements. There's your saving—and no question about it. And don't forget that aluminum's light weight makes it easy to handle. The weight it saves is weight you'll *never* have to heft, load, unload and carry to an installation site! The savings in dollars and ease of installation speak for themselves. If you'd like the complete story on performance, availability and installation, contact your nearby Rome distributor or sales representative. Rome Cable, Division of Alcoa, Dept. 7-91. Rome, New York.



ALUMINUM service entrance cable from the Rome Cable Division of Alcoa is available in two- or three-conductor types, insulated with Underwriters-approved heat- and moisture-resistant compound. The insulated conductors are enclosed in a color-coded protective tape. The concentric conductor consists of a spirally applied conductor having a circular mil area equivalent to the AWG size specified for the neutral conductor.

ALCOA
ROME CABLE
DIVISION



ROME SERVICE ENTRANCE CABLE

THREE CONDUCTOR • TYPE "SE" • STYLE "U"

Underwriters Approved

COPPER			ALUMINUM			SAVINGS	
CIRCUIT RATING IN AMPS	INSULATED CONDUCTOR SIZE AWG	LIST PRICE PER 1000 FT.	CIRCUIT RATING IN AMPS	INSULATED CONDUCTOR SIZE AWG	LIST PRICE PER 1000 FT.	DOLLARS	PERCENTAGE (Approx.)
60	6	241	60	4	235	6	2%
100	3	407	100	2	303	104	26%
125	1	784	125	1/0	472	312	40%
150	1/0	947	150	2/0	520	427	45%
200	3/0	1390	200	4/0	704	686	49%

*** KILLARK "GR" SERIES JUNCTION BOX . . .** available in eight sizes from 4⅝" x 4⅝" x 4½" to 11" x 12" x 8¼". Choice of dome covers in four heights to facilitate heavy splicing or mounting terminal blocks. Also available with flat blank covers or lens covers for instrument mounting. Lens is heavy shock proof, stressed glass, as strong as the casting.

Copper-free aluminum casting with reinforced construction and convenient mounting lugs. Custom hubs can be placed where needed; drains and breathers available. Explosion-proof, dust-tight, and weatherproof. U. L. approved for hazardous and non-hazardous locations.

There are more than 200 other Killark Junction Boxes from which to choose the exact style and size you need for any installation.
Write for illustrated catalog.

"Any size and style you need—because the Killark line is complete!"

OVER 7,500 ELECTRICAL FITTINGS AND FIXTURES

Only Killark provides copper-free aluminum equipment in such a complete range of sizes and styles. Having the right enclosure available for the application means greater design freedom, better operating efficiency, lower costs.

YOU GET FAST DELIVERY ON KILLARK ELECTROLETS

Order from your Killark distributor. He has the item you need in stock for immediate delivery. If not, he can get it promptly from a nearby Killark warehouse. There are 18 of these dependable supply sources located throughout the United States and Canada.

Killark

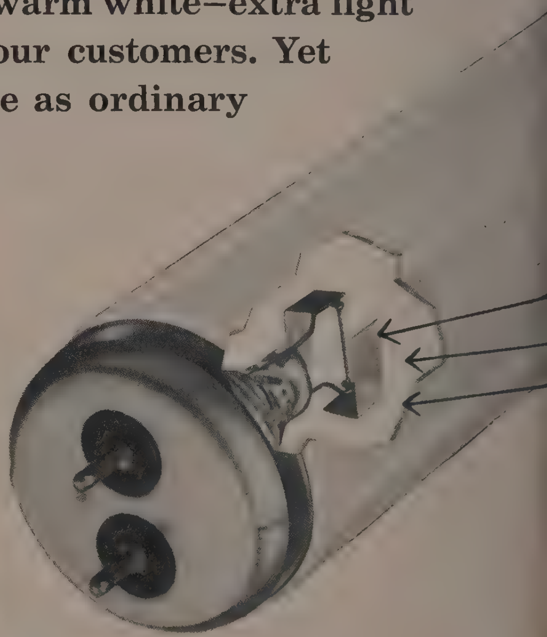
ELECTRIC MANUFACTURING COMPANY
Vandeventer and Easton Ave. • St. Louis 13, Missouri
In Canada: Killark Electric of Canada, Ltd., 421 Islington Ave. South, Toronto 18, Ont.

6116

General Electric brightest 40-watt fluorescent ever

Here's money-saving news for 40-watt fluorescent users. General Electric's NEW F40 gives a 7% bonus in light at no extra cost. Now your customers can get their desired lighting level with fewer lamps and fixtures. Or they can increase their existing lighting level without spending a single extra penny for lamps, fixtures or electricity.

Only General Electric offers this bonus in standard 40-watt "white" fluorescent lamps. The G-E NEW F40 is rated at 3100 lumens in popular cool white, 3250 in white or warm white—extra light worth 15¢ to 30¢ a lamp to most of your customers. Yet the list price for this lamp is the same as ordinary fluorescents.



NEW F40 ONLY $1.30 LIST

announces the cool-white made...

The bonus of light your customers get with General Electric's *NEW F40* is made possible because of these G-E Premium 3 construction features:

1. **G-E wattage-miser electrode helps convert power ordinarily lost in the cathode into useful light—free.**
2. **New, more efficient gas mixture.**
3. **New electronically screened bonus-phosphor.**

And all these light producing features are available for the first time in a lamp that sells for the same price as ordinary fluorescents—only $1.30 for the popular cool white, $1.35 for other "white" colors.

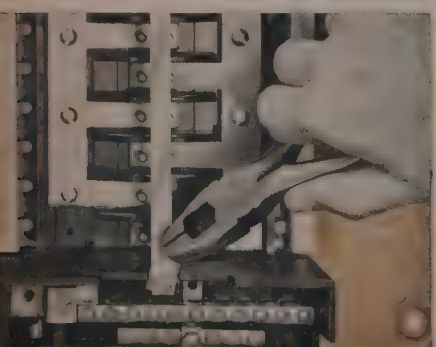
Designed for both Rapid Start and starter-type circuits, the *NEW F40* has a life rating of 7500 hours for most circuits (6000 hours for systems installed before 1954). To get 7500-hour life in pre-'54 circuits, F40/54 lamps are available. They give the same light as ordinary 40-watt fluorescents (2900 lumens) and list for the same price ($1.30 in cool white). General Electric Co., Large Lamp Dept. C-122, Nela Park, Cleveland 12, Ohio.

Progress Is Our Most Important Product

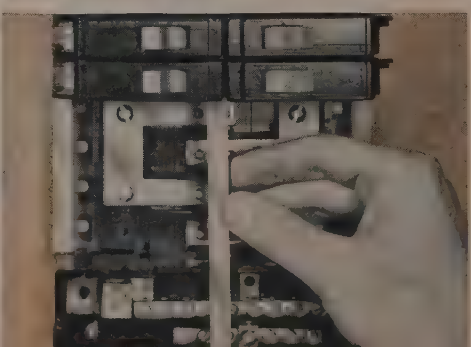
GENERAL ELECTRIC

SIMPLEST, MOST FOOLPROOF N. I. SYSTEM BY FAR—NO SPECIAL TOOLS REQUIRED FOR INSTALLATION Simplified Safetybreaker system eliminates fussy keying systems, makes it impossible to incorrectly position tabs. Here's the Safetybreaker method:

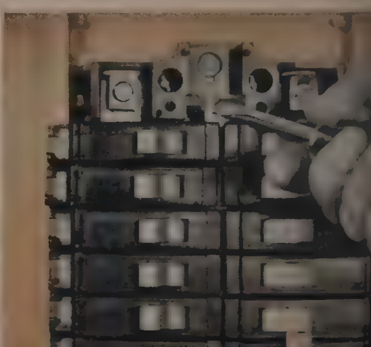
1 Simply tear off soft plastic spacers to loosen locking-bar screws, and let locking bar drop.



2 Plug in breakers in top portion of panel. Slide bar to top of panel.



3 Plug in remaining breakers. Tighten two screws to lock the NI system.



CONTROL

Why settle for an old-fashioned "basement gray" box?

Get this new, smartly-styled safetybreaker...it doesn't cost a nickel more

(and often costs less!)

Here's a bonus in beauty and protection that gives you—and your customers—extra features at no extra cost.

Modern appliance styling lets you show how good your wiring job is. This soft sandalwood finish *belongs* upstairs, convenient to the kitchen, saving you on those heavy wiring runs.

Eliminates housewife confusion and saves you unnecessary call-backs. Simple as a light switch, with easy-to-see "on" and "off" positions. There is no tripped mid-position to harass the homeowner, no calls for you to reset the breaker because the housewife mislaid or misread instructions.

Inside as superior as the outside. Won't rust, won't corrode because every operating part is either stainless steel or heavily plated. Double protection with magnetic trip for short circuits *and* bimetal trip for sustained overloads. Easier to install with plenty of wiring room, no knuckle-skinning wire guides.

Want to know more about Cutler-Hammer's New Safetybreaker? Write for free 36-page Safetybreaker Selection Guide. Better yet, see your Cutler-Hammer distributor and let him show you personally.

What's new at Cutler-Hammer? This new Safetybreaker is typical of the *better* products you'll be getting from Cutler-Hammer . . . results of new engineering talent . . . new facilities . . . a new creative atmosphere at every level.

WHAT'S NEW? ASK...

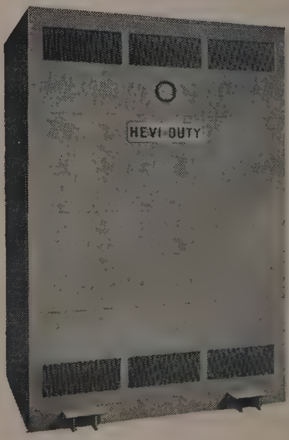
CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. • Associates: Cutler-Hammer Canada, Ltd.; Cutler-Hammer Mexicana, S. A.

CONTROL

The best ears agree

Hevi-Duty Dry-Type Transformers... so quiet you'll get no complaints



Schools, hospitals, motels, hotels... wherever quiet is the first order of business . . . you'll find Hevi-Duty dry-type transformers your smartest choice for installation.

Cores and coils are especially designed to give low decibel ratings. Moisture and corrosion-resistant polymerizing varnish is baked on in two separate operations. Besides giving excellent electrical protection, this results in substantially reduced noise levels. All laminations and components are bonded together tightly to cut vibrations.

Be sure you obtain these features. Specify Hevi-Duty transformers . . . or write the following into your specifications: Coil and cores "double-impregnated with polymerizing varnish."

For more information, write for Bulletins 100 and 200 or call your nearest Hevi-Duty sales office.

Designed sound levels for typical Hevi-Duty dry-type transformers

SINGLE-PHASE		THREE-PHASE	
KVA	DECIBEL RATING	KVA	DECIBEL RATING
1.0	33	6.0	38
7.5	33	9.0	40
10.0	40	15.0	44
20.0	44	30.0	43
37.5	44	45.0	45
75.0	45	112.5	45
100.0	45	150.0	45
167.0	45	225.0	50
250.0	50	300.0	50
500.0	52	500.0	53

Transformers up to 1000 KVA can be supplied with sound levels of 45 decibels.

HEVI-DUTY

Dry-Type Transformers
Constant Current Regulators

BP
C

HEVI-DUTY ELECTRIC COMPANY
MILWAUKEE, WISCONSIN
A Division of Basic Products Corporation

H-31-61

SPANG
CONDUIT

New!
SPANG
BLUE STAR CONDUIT

Now—from Spang comes a new improved galvanized rigid steel conduit. Here's what it offers you:

NEW—*best thread protection available against rust*

. . . a smooth, uniform zinc galvanized coating on every ridge and valley of every thread . . . easy coupling—can be hand tightened the whole way . . . no thread chasing . . . no excess zinc . . . Preece-tested to assure quality and dependability.

NEW—*double galvanized coating on the conduit for extra corrosion resistance*

. . . inhibits white rust formation . . . eliminates flaking of finish . . . has that fine spanGleam appearance.

NEW—*better packaging for easier handling*

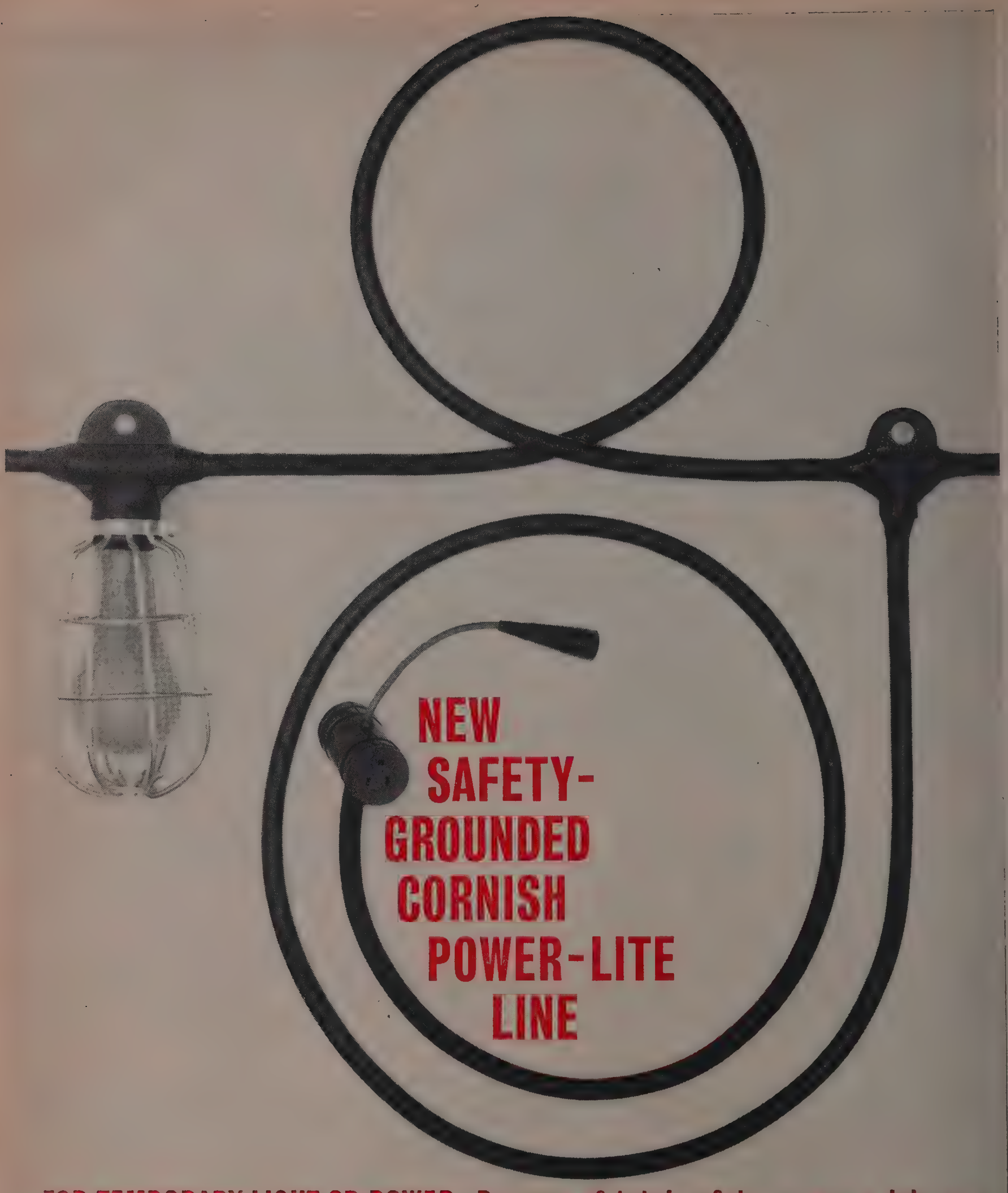
. . . bundled in steel strapping in sizes up through 2" . . . shipped on a one-ton rectangular lift for convenient transit by lift truck...cuts handling costs—makes inventory easier.

* * *

Save installation time, get top protection against rust and corrosion with new Spang Blue Star Galvanized Rigid Steel Conduit. See your nearby Spang Distributor for complete details and samples.

Spang Blue Star Conduit is one of the many fine products produced by *National Supply Division, Armco Steel Corporation, Two Gateway Center, Pittsburgh 22, Penna.*

ARMCO National Supply Division



FOR TEMPORARY LIGHT OR POWER—Be sure of total safety on every job—use grounded Cornish portable **POWER-LITE LINE**. Rated at 125 volts—15 amps, UL-approved **POWER-LITE LINE** has weatherproof, molded-on 3-conductor male and female connectors. Double-outlet plugs, too, have ground wire. Lamp outlets are molded with shade-holder grooves for guards or reflectors. Molded hangers make installation easy as driving a nail. Distributors are everywhere—coast to coast. See your phone book. ☐ Cornish Wire Co., 50 Church St., New York 7, N.Y.

CORNISH

60TH YEAR • SEPTEMBER 1961

ELECTRICAL
CONSTRUCTION
AND MAINTENANCE

Better Times Ahead

Conceding some late summer doldrums there is an increasing number of signs that the national economy is hitting a new and more vigorous pace. Prospects are excellent for a sustained period of strong and even spectacular economic growth through 1962 and beyond.

The electrical industry should fare very well indeed in these coming months because it will be participating not only in the general upturn but also in its own advancing technology. A more favorable economic climate is bound to encourage broader markets for more sophisticated and advanced electrical systems, lighting applications, heat, power, communication and control.

While construction volume has held up handsomely through many months of business uncertainty and recession, the psychology of these times has had a restraining influence on electrical systems design. Under recession pressures budget-paring on construction projects becomes an end in itself and electrical work invariably suffers.

Better times will help to dispel a lot of prideless austerity in design and allow more emphasis on value, quality and performance. But the electrical industry has got to learn to take a much firmer stand in its own and in its customers' interests against so-called economies achieved by arbitrarily cutting the electrical contract, and stripping it of advanced features and premium values.

The times ahead present both challenge and opportunity. There are many new products, systems and standards of exceptional value and utility for the customer ready and waiting to be incorporated into practical working installations. New frontiers of lighting performance are in prospect. Electric heat in many areas is hardly off the ground. And the markets for new concepts in control and communications are yet to be explored.

A dynamic up-sweep in the economy deserves a rededication on the part of the electrical industry to real values and a strong sense of obligation to the public. Many important developments can reach the public effectively only with the active support and encouragement of electrical engineers and contractors. The customer has to look to us for expert advice, guidance and ultimate performance. He has a right to expect, not the least or cheapest, but the very best of our goods, services and talents.

Wm. T. Stuart

KNOW YOUR SYMBOLS

This symbol stands for fusible switch

This symbol stands for QUALITY

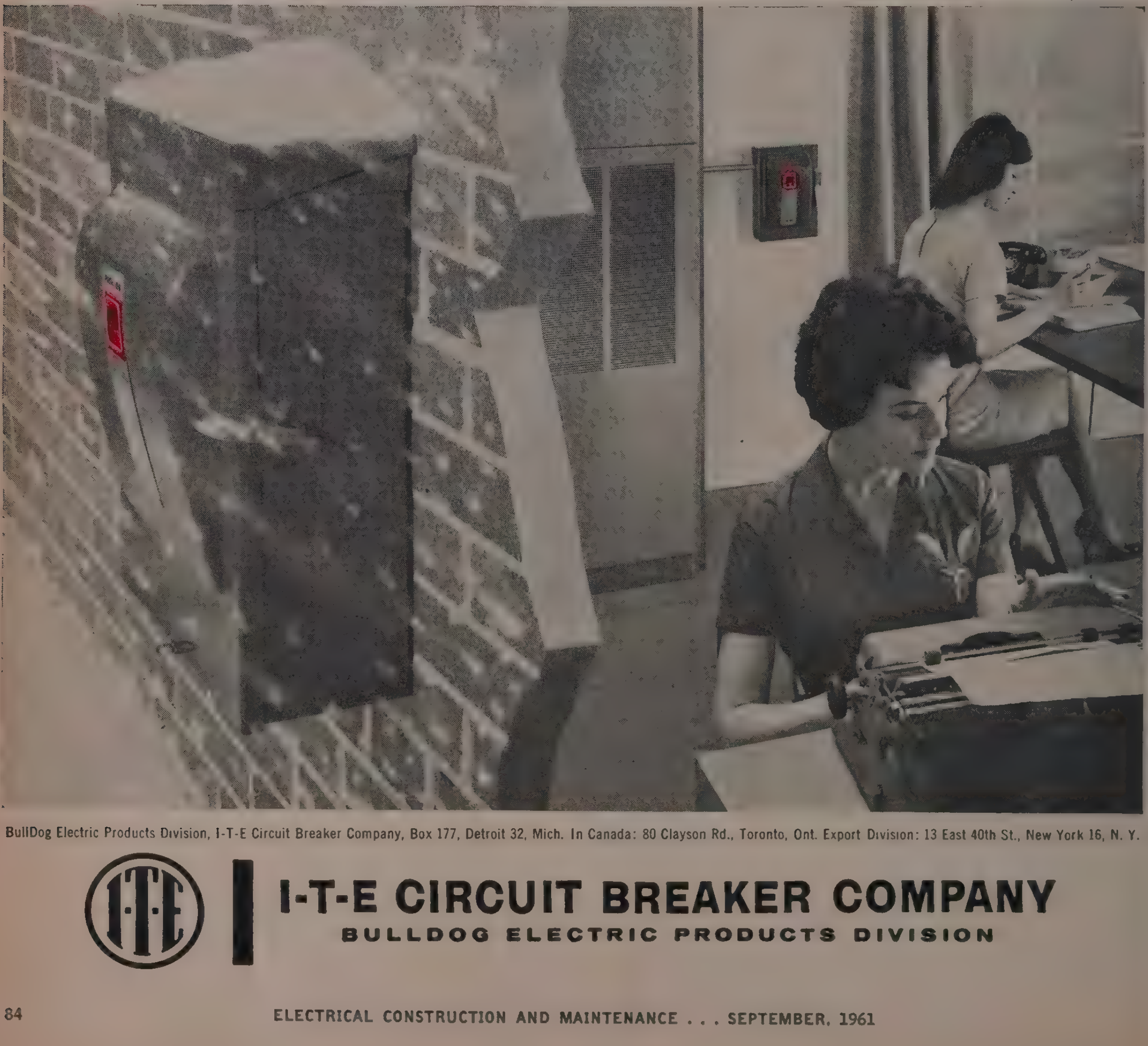
THE SAFETY SWITCH THAT CHALLENGES COMPARISON!

BullDog's general-duty safety switch – a star performer indoors and out!

All BullDog general-duty safety switches, in either indoor or raintight enclosures, combine these outstanding features for maximum safety and dependability:

- Minimum arcing—double-break switching
- Arc control—Vacu-Break® enclosed chamber
- Pressure contacts—Clampmatic® spring action
- Positive switching—direct handle operation

. . . Plus, all current-carrying parts are silvered. And with BullDog, you sell a complete line, competitively priced, that fills all over-the-counter calls for general-duty safety switches. The switches are available in both NEMA 1 and NEMA 3R enclosures. Challenge our field representative to prove these switches are the finest . . . or write BullDog for details.



BullDog Electric Products Division, I-T-E Circuit Breaker Company, Box 177, Detroit 32, Mich. In Canada: 80 Clayson Rd., Toronto, Ont. Export Division: 13 East 40th St., New York 16, N. Y.

I-T-E CIRCUIT BREAKER COMPANY

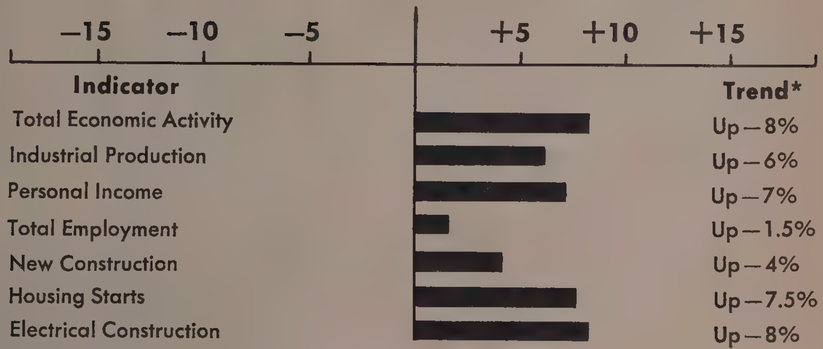
BULLDOG ELECTRIC PRODUCTS DIVISION

ELECTRICAL
CONSTRUCTION
AND MAINTENANCE

SEVENTH ANNUAL STATISTICAL SUMMARY

ECONOMIC OUTLOOK

(Trends for 1962)



*Change from 1961
E C & M estimate, mid-1961.

PLAN NOW FOR

Record Electrical Growth IN 1962

Our economy, surging upward at an accelerating pace and pressured by increased spending by Government, business and consumers, supports an optimistic outlook for record growth and progress for the electrical industry through 1962.

By Berlon C. Cooper

• The National Economy

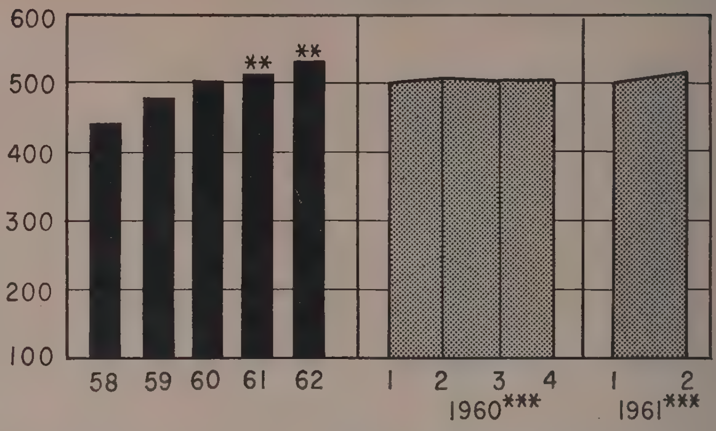
THE U. S. economy is headed for spectacular growth over the next 15 months, or through 1962. This optimistic outlook is substantiated through analysis of each and every economic indicator, and especially through analysis of cyclical fluctuations of such indicators as gross national product and industrial production over the past several years. The historical pattern of some of the more important national economy indicators is presented in this report, on a short-range basis, or generally for 1958 to mid-1961. Each of these indicators, however, should be analyzed in the light of the current status of the economy, of current spending plans of the Federal government, of an expanded consumer buying power, of the impact of government and consumer purchases on production in the months ahead, and of all economic forces expanding further and reinforcing one another.

Consider gross national product, for example. Beginning in mid-1959, GNP declined from an annual rate of nearly $490 billion to about $475 billion by the end of that year, due primarily to the extended steel strike during this period. Then

Economic activity for 1961 as a whole will rise slightly over 2% from 1960, about the same as 1960 rose over 1959. But the annual rate by the end of 1962 will rise at least 8% above the current annual rate, based on the mid-1961 outlook. The outlook is for an annual rate of at least $570 billion by the end of 1962.

GROSS NATIONAL PRODUCT

(Billions of Dollars)*

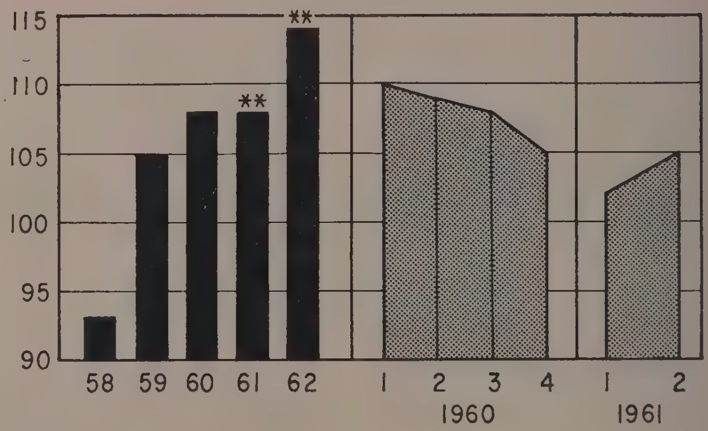


* Current dollars
** EC&M estimate, Mid-1961.
*** Current dollars, seasonally-adjusted annual rate.
Source: Office of Business Economics, Dept. of Commerce.

Switch from inventory liquidation to replacement, rising consumer purchases of both durable and nondurable goods, and expanding government spending for arms, public works, housing and other capital goods (Federal, state and local) will put new pressures on industrial production in the months ahead.

INDUSTRIAL PRODUCTION

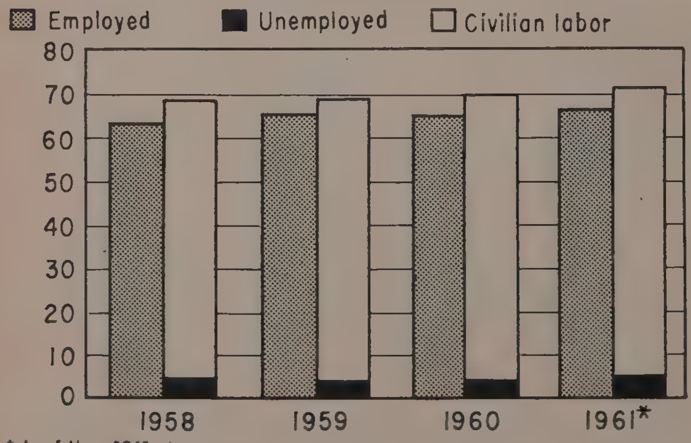
(FRB Index)*



* 1957 = 100
** EC&M estimate, Mid-1961.

EMPLOYMENT AND UNEMPLOYMENT

(Millions of Persons)



* As of May, 1961
Source: Bureau of Labor Statistics, Dept. of Labor.

in 1960, it quickly rebounded to $501 billion during the first quarter, to $505 billion in the second quarter, then declined slightly through the first quarter of 1961 to slightly under $500 billion. Thus, from mid-1959 through the first quarter of 1961, economic growth was at an approximate standstill, or actually on a plateau but showing no growth. Then, during the second quarter of this year, GNP rebounded to an annual rate of $515 billion, and continued at this level, due to the usual summer lull, through the third quarter. Already, production is picking up and GNP is responding to the usual autumn surge, will probably reach an annual rate of $535 to $540 billion by year's end. Economic growth through 1962 is expected to continue at a rate of about 8%, taking into account the

PERSONAL INCOME, TAXES, DISPOSABLE PERSONAL INCOME

(Billions of Current Dollars)

Personal income has continued to increase from year to year since 1958, notwithstanding the economic downturn of 1960-61. But consumers increased savings while they curtailed their spending.

Year	Personal Income	Taxes Federal	 State	Disposable Personal Income
1958	360.3	36.7	5.7	317.9
1959	383.3	39.8	6.2	337.3
1960	404.2	43.3	6.7	354.2
1961*	420.0*	50.0*		370.0*
1962*	450.0*	57.0*		393.0*
Quarterly**				
1960—1st	396.2	42.6	6.6	347.0
—2nd	404.2	43.4	6.6	354.1
—3rd	408.0	43.8	6.7	357.5
—4th	408.5	43.6	6.8	358.1
1961—1st	407.5	43.3	7.1	357.2
—2nd	413.6*	50.0*		363.0*

*EC&M Estimate, Mid-1961.
** Seasonally-adjusted annual rate.
Source: Office of Business Economics, Dept. of Commerce.

CONSUMER SPENDING

(Billions of Dollars)

Year	Durable Goods	Nondurable Goods	Services	Personal Consumption Expenditures
1958	37.6	141.9	113.4	293.0
1959	43.0	147.9	120.7	311.0
1960	43.6	152.4	131.8	327.8
1961*	39.2	153.0	136.6	328.8

*For 1st quarter 1961 only, sasonally-adjusted annual rates.
Source: Office of Business Economics, Dept. of Commerce.

CONSUMER CREDIT

(Billions of Dollars)

Year	Installment Credit	Noninstallment Credit	Total Consumer Credit
1958	34.1	11.5	45.6
1959	39.5	12.6	52.1
1960	43.3	12.8	56.1
1961*	42.0	12.0	54.0

*End of April, 1961.
Source: Office of Business Economics, Dept. of Commerce.

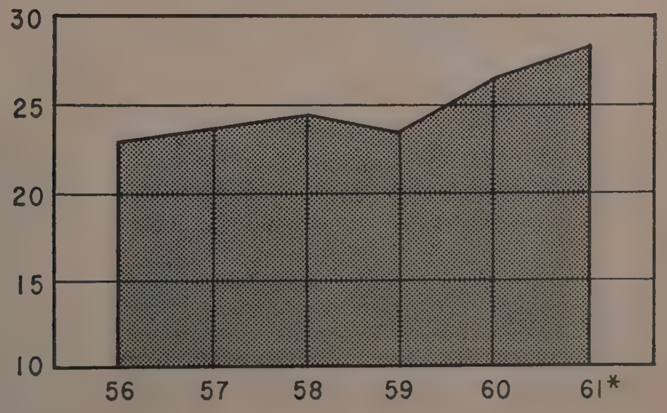
economic pressures which are now indicated.

Similar patterns exist in the GNP growth curve at two recent periods. In mid-1953 GNP declined slightly to mid-1954, then rebounded sharply to the end of 1957. Again, from mid-1957 to mid-1958, GNP declined slightly, then surged upward to mid-1959 when the steel strike halted the climb.

Industrial production has followed about the same cyclical pattern as that indicated by GNP, except that the declines have been more pronounced, and the growth rates have been greater. The production declines and periods of growth have coincided with those for GNP. The FRB Index of industrial production in July was 112% (of 1957 average), exceeding the previous record of 111% in January

PERSONAL SAVINGS

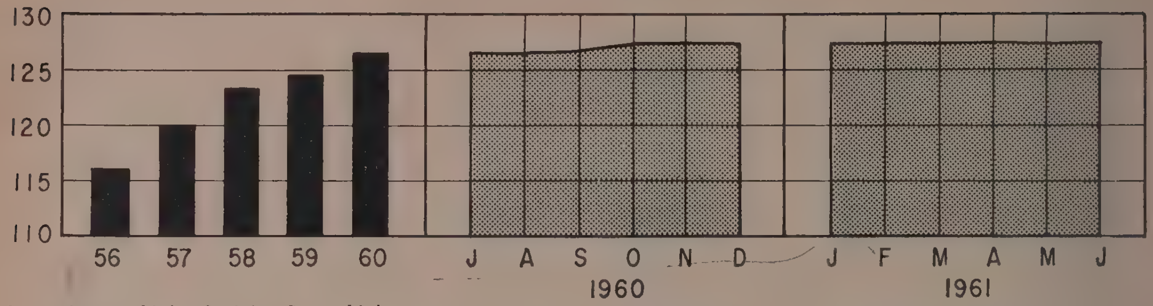
(Billions of Dollars)



Source: Dept. of Commerce.
* Seasonally-adjusted annual rate, 1st Q., 1961

COST-OF-LIVING

(Consumer Price Index: 1947-49 = 100)



Source: Bureau of Labor Statistics, Dept. of Labor.

FEDERAL GOVERNMENT SPENDING AND GROSS DEBT

(Billions of Dollars)

Fiscal Year	Major National Security	Veterans' Services and Benefits	Agriculture and Agricultural Resources	Interest	All Other	Total	Public Debt
1958	44.1	5.0	4.4	7.7	10.1	71.4	276.3
1959	46.4	5.2	6.5	7.7	14.5	80.3	284.7
1960	45.6	5.0	4.8	9.3	11.7	76.5	286.3
1961	....	...	...	...	....	81.5	288.8

Source: Federal Reserve Bulletin.

FEDERAL GOVERNMENT INCOME

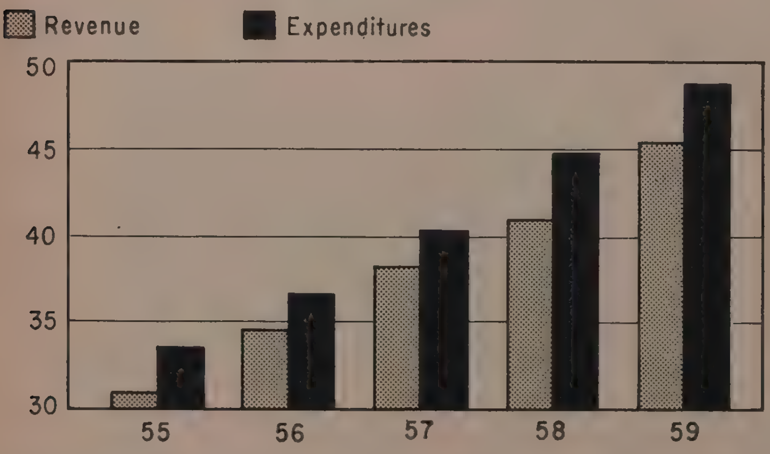
(Billions of Dollars)

Fiscal Year	Individual Income	Corporation Income	Excise Taxes	All Other	Total
1958	34.7	20.0	8.6	5.1	68.6
1959	36.7	17.3	8.5	5.4	67.9
1960	40.7	21.5	9.1	6.4	77.8
1961	....	....	...	...	77.6

Source: Federal Reserve Bulletin.

STATE AND LOCAL GOVERNMENT SPENDING

(Billions of Dollars)



Source: Federal Reserve Bulletin.

1960, and is expected to climb to about 120%-122% by end of 1962.

Disposable personal income, or income after taxes, has been growing steadily since mid-1958, while prices have remained relatively stable. Thus, consumer buying power is at an all-time high. In fact, personal income has been rising at a faster rate since 1958 than GNP.

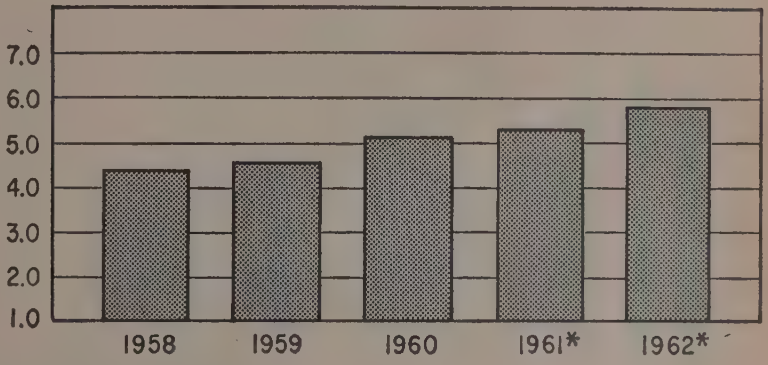
Federal government spending is at an all-time high, is destined to continue its climb at least over the next two or three years. Budgeted expenditures in fiscal 1961 were $81.5 billion, while tax receipts totaled only $77.6 billion. Budgeted expenditures for fiscal 1962 are now estimated at about $88 billion, following recent additional authorizations for national defense. Administration economists and officials believe that the expanded economy will provide the necessary additional revenue to meet the higher spending plans.

State and local government spending is increasing at a rate of about 10% per year, and revenues are increasing at about the same rate. Revenues are not matching expenditures, and higher taxes, or further Federal subsidization, is needed to maintain balanced budgets.

● The Electrical Industry

ELECTRICAL WORK IN CONSTRUCTION

(Billions of Dollars)



* EC&M estimate, as of mid-1961.

1961 ELECTRICAL CONSTRUCTION

(Millions of Dollars)

Type of Construction	Volume*
Private Funds	
Residential	905
Industrial	527
Commercial and institutional	950
Utilities	407
Farms	91
Other	10
Total Private	**2,890**
Public Funds	
Residential	27
Industrial	68
Educational	392
Institutional	213
Military	43
Highway and conservation	290
Other	20
Total Public	**1,053**
Total for new construction	**3,943**
Total for modernization and repair	**1,400**
Total electrical construction work	**5,343**

*EC&M estimate as of mid-1961.

THE electrical industry, bolstered by a booming national economy, will soar to new records during the next 15 months. Practically all segments of the industry will participate in this upturn.

During 1962, new records will be set in electric power production and sales, in electrical construction work, in lighting equipment and light source sales, in electric space heating jobs installed, in electric machinery and equipment production and sales, in electronics production, in over-all electric appliance sales, and in other phases of electrical industry endeavor.

This optimistic outlook is supported by trends and growth patterns now indicated and rapidly emerging for the nation's economy, and especially for those segments of the economy on which the electrical industry is most dependent for its growth. Trends and growth patterns for some of the major economic factors are given in the accompanying charts and tables, as well as for some of the major segments of the electrical industry.

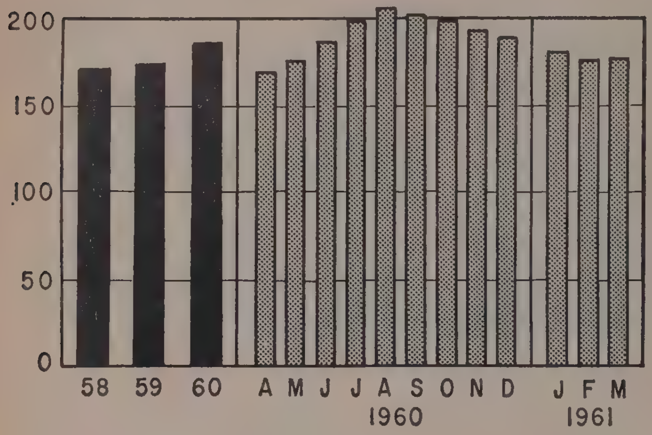
Since the nation's economy has coasted along for the past couple of years without any significant growth (GNP actually declined in the 3rd and 4th quarters of 1960, and 1st quarter 1961), the forces contributing to the outlook for an economic boom already getting under way show up in existing and growing economic pressures, rather than in the statistical record. Basically, these pressures include: 1) an increasing demand for consumer goods and services; 2) a change from inventory liquidation to inventory accumulation; 3) an upturn in capital spending for plant and equipment; 4) disposable personal income and personal savings are at record highs; 5) government spending is at record highs, and increasing; and 6) new construction activity has again started to expand. These forces are interacting, and tend to reinforce one another. When combined with the record of a $515 billion economy at mid-1961, these forces add up to a boom by year's end, and a possible superboom in the year ahead.

Just how sound this economic growth may be is another subject, and beyond the scope of this report. As a matter of record, however, it should be pointed out that some government officials are already concerned that this anticipated boom may get out of hand; that anti-inflationary measures may have to be adopted later on. Consider the $515 billion GNP total at mid-1961, for example. It includes government spending, as well as all other private spending for goods and services. And government spending at mid-1961 consisted of approximately $100 billion annual rate by the Federal government (including Social Security and other social and welfare payments), and approximately $60 billion by state and local governments—or combined, about 31% of the $515 billion GNP total.

Federal spending is now increasing at the sharpest annual rate in peace-time history, with prospects for an accelerating pace in the foreseeable future, for national defense, foreign aid, military expansion, space age research and development, and domestic economic and social programs. It is the Administration's hope that national eco-

ELECTRICAL WORKERS IN CONTRACT CONSTRUCTION

(Thousands of Workers)



Source: Dept. of Labor, Bureau of Labor Statistics.

ELECTRICAL WORKERS' HOURS AND EARNINGS

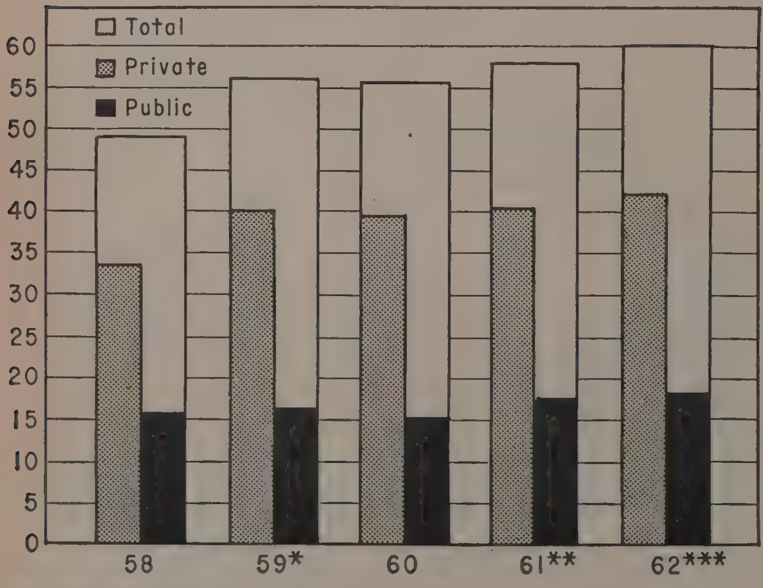
Year	Average Weekly Hours	Average Weekly Earnings	Average Hourly Earnings
1958	38.3	$135.97	$3.55
1959	38.4	142.08	3.70
1960	38.4	149.38	3.89
1960—Apr.	38.3	147.07	3.84
—May	38.5	148.23	3.85
—June	38.7	149.38	3.86
—July	38.7	150.93	3.90
—Aug.	38.9	151.32	3.89
—Sept.	38.7	151.70	3.92
—Oct.	39.1	155.62	3.98
—Nov.	37.8	149.31	3.95
—Dec.	37.7	148.92	3.95
1961—Jan.	38.4	153.60	4.00
—Feb.	38.5	154.39	4.01
—Mar.	38.8	156.36	4.03

Source: Dept. of Labor, Bureau of Labor Statistics.

nomic growth will expand adequately so that existing tax rates will create enough revenue to meet these expanding Federal expenditures. If not, then additional taxes will be imposed. Also, in case of inflationary pressures, actions are being readied to hold inflation in check—including price, wage and inventory controls, and a possible clamp-down on credit by FRB.

GROWTH OF NEW CONSTRUCTION

(Billions of Dollars)



* New statistical series includes Alaska and Hawaii.
** BDSA estimate, mid-1961.
*** EC&M estimate, mid-1961.
Source: Business and Defense Services Adm., Dept. of Commerce.

Electrical Construction Work

The outlook for electrical construction work in 1962 is for an increase of about 8% over the total for 1961. The total dollar volume is set at $5,770 million for 1962, which compares with an estimated $5,343 million total for 1961. This increase will result from two factors—an increase of about 4% in new construction, and a further increase of about 4% for advancing standards and expanding technology.

A breakdown of electrical construction work being done this year is shown in the table "1961 Electrical Construction." Analysis of this table indicates that over half of the dollar volume (54%) comes from new construction paid for by private funds, and one-fifth (20%) comes from new construction paid for by public funds. The remaining 26% of electrical construction work is for modernization and repair.

The number of electrical workers now engaged in contract construction is averaging about 5,000 more than for the similar period of 1960, but this number should increase if residential construction continues to pick up as now seems likely.

The average hours worked per week by electrical workers is picking up fractionally, while weekly earnings are up 4.4% from a year ago, and hourly earnings are up 4.7% from the similar period of 1960.

New Construction Activity

In 1960, construction suffered its first annual decline since the end of World War II. Building dollar volume had made annual gains for 15 years in a row. The drop was only 2%, from the 1959 record of $56.0 billion, to $55.6 billion, and may be attributed principally to the $2 bil-

1961 OUTLOOK FOR NEW CONSTRUCTION

(Millions of Dollars)

Type of Construction	Dollar Value Actual 1959	 1960	 Estimate* 1961	% Change 1960/1961
TOTAL NEW CONSTRUCTION	**56,033**	**55,556**	**57,800**	+4
PRIVATE CONSTRUCTION (Total)	**39,848**	**39,603**	**40,300**	+2
Residential buildings (non-farm)	24,469	22,546	22,500	....
New dwelling units	19,233	16,422	16,000	−3
Additions and alterations	4,468	5,199	5,300	+2
Nonhousekeeping	768	925	1,200	+30
Nonresidential buildings (non-farm)	8,859	10,168	10,625	+4
Industrial	2,106	2,851	3,000	+5
Commercial	3,930	4,180	4,400	+5
Office buildings and warehouses	1,954	2,121	2,250	+6
Stores, restaurants and garages	1,976	2,059	2,150	+4
Other nonresidential buildings	2,823	3,137	3,225	+3
Religious	947	1,013	1,025	+1
Educational	525	566	610	+8
Hospital and institutional	570	605	715	+18
Social and recreational	550	707	625	−12
Miscellaneous	231	246	250	+2
Farm construction	1,261	1,285	1,300	+1
Public utilities	5,052	5,323	5,575	+5
Railroad	251	285	260	−9
Telephone and telegraph	952	1,088	1,040	−4
Electric light and power	2,072	2,058	2,150	+4
Gas	1,657	1,767	2,000	+13
Other public utilities	120	125	125	....
All other private	207	281	300	+7
PUBLIC CONSTRUCTION (Total)	16,185	15,953	17,500	+10
Residential buildings	962	716	800	+12
Nonresidential buildings	4,502	4,792	5,250	+10
Industrial	360	407	500	+23
Educational	2,656	2,818	3,050	+8
Hospital and institutional	428	400	400	....
Administrative and service	564	598	675	+13
Other nonresidential buildings	494	596	625	+10
Military facilities	1,459	1,386	1,600	+15
Highways	5,888	5,464	5,900	+8
Sewer and water systems	1,467	1,487	1,625	+9
Sewer	906	882	900	+2
Water	561	605	725	+20
Public service enterprises	551	649	700	+8
Conservation and development	1,127	1,221	1,300	+6
All other public	229	238	325	+37

*BDSA mid-year estimate.

Source: Business and Defense Services Adm., U. S. Dept. of Commerce.

lion decline in residential construction in 1960.

During the first six months of this year, new construction activity was struggling along at about the same rate as during the first six months of last year. Then, in June and July, the pace quickened. At mid-year, Dept. of Commerce revised its forecast of construction activity to reflect emerging new trends. Their forecast is for a new record high of $57.8 billion for the year, up 4% from 1960. The detailed forecast, showing trends for each type of construction, are shown in the table "1961 Outlook for New Construction."

Private expenditures for housing in 1961 are expected to be slightly lower (3%) than in 1960. But small increases in other types of private construction are expected to more than offset the reduced housing ex-

BACKLOG OF PROPOSED ENGINEERING CONSTRUCTION

(Thousands of dollars)

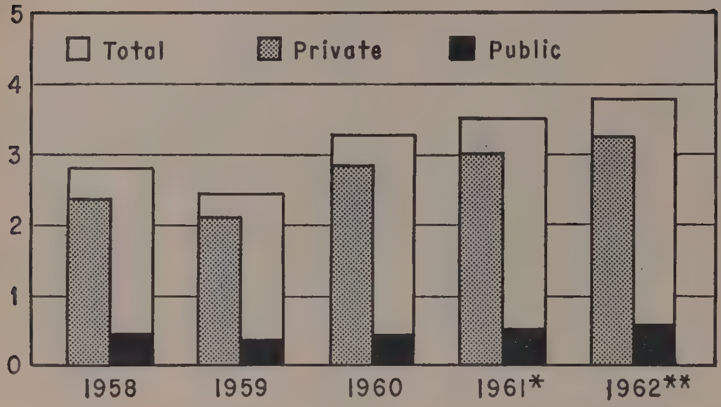
Type of Construction	Backlog*	% of Total
Private Projects		
Bridges	100,862	0.1
Industrial buildings	17,449,955	13.9
Commercial buildings	28,293,047	22.6
Unclassified	10,762,582	8.6
Total private projects	**56,606,446**	**45.2**
Public Works Projects		
Waterworks	3,127,830	2.5
Sewerage	4,267,546	3.4
Bridges	3,244,271	2.6
Earthwork, irrigation, drainage	11,985,689	9.6
Streets and roads	13,283,740	10.6
Buildings	22,818,224	18.3
Unclassified	9,773,699	7.8
Total public works projects	**68,500,999**	**54.8**
Total backlog (private and public)	**125,107,445**	**100.0**
Federal Government work, included in public works projects	**13,849,324**	**11.1**

*For United States, including Alaska and Hawaii, as of June 30, 1961

Source: *Engineering News-Record.*

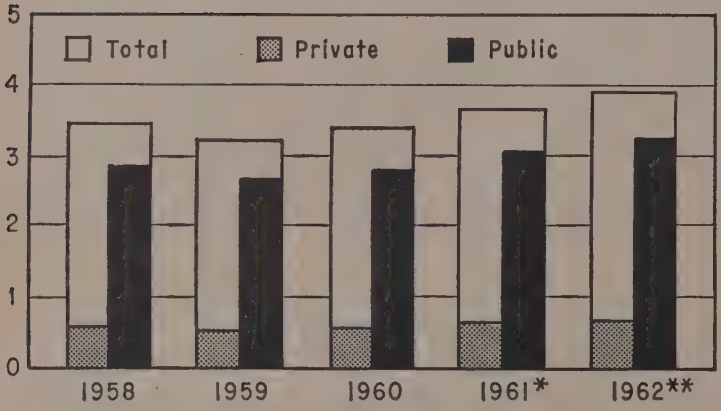
INDUSTRIAL CONSTRUCTION

(Billions of Dollars)



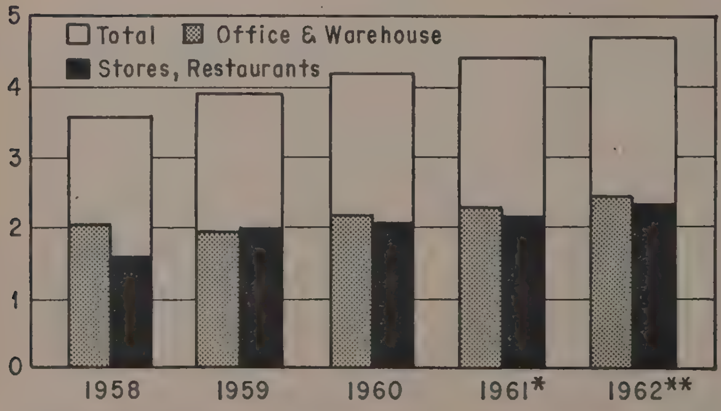
SCHOOL CONSTRUCTION

(Billions of Dollars)



PRIVATE COMMERCIAL CONSTRUCTION

(Billions of Dollars)



* BDSA estimate, mid-1961.
** EC&M estimate, mid-1961.
Source: Dept. of Commerce.

penditures. The over-all gain for total private construction is only 2%, but the expenditures involved will represent a new peak of $40.3 billion. The forecast for public construction is for a healthy 10% gain over the 1960 total.

Expenditures for nonresidential types of private construction show moderate gains generally for most categories. Gains are particularly strong for hospitals, educational buildings, and gas utilities. Industrial expenditures, up 5% in 1961 compared with a 35% increase in 1960, reflect mainly a very large carryover of activity from projects started in 1960.

Public construction, forecast at $17.5 billion in 1961, shows strength in every category except hospital construction, which is holding at the 1960 level. Highways, at a $5.9 billion total, account for more than one-third of the public spending total. Military construction, at $1.6 billion, will be higher than at any time since 1943, and reflects work on the missile base program. The office building program of the Federal Government continues to be a major factor in the boom foreseen in the administrative and service building category. Public industrial buildings and water facilities are also showing strong upward trends.

Except for a 11% decline in 1959, industrial construction is continuing its rapid climb—up a total of 25% in four years (1958-61). It is expected that this rate of increase will maintain through 1962, bolstered by new construction for more production capacity as production climbs during the coming months.

Public school construction will total over $3 billion this year, for a record, and continuing a surge that began two years ago. Total expenditures for both public and private schools are expected to reach a record $3.9 billion in 1962, reflecting an annual growth rate of over 5%, or considerably more than the national economy growth rate over the same period.

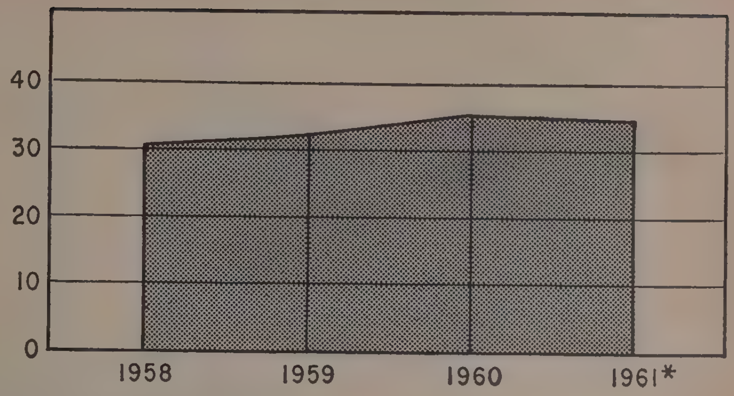
Private expenditures for commercial construction, an area of high percentage for electrical construction in relation to total construction costs, are also expected to set new records this year, and to expand still further in 1962.

Private and public housing starts in 1961 are expected to total 1,325,000, or about 4% more than in 1960. Of this total, 1,275,000 will be of the privately-financed type, an increase of 37,000 over 1960. But the dollar outlays will probably be somewhat lower, mainly because of the delay in the upward turn in housing, and the increasing trend towards apartment-house construction, which involves lower prices per unit. Outlays for public residential building is expected to total \$800 million in 1961, a 12% gain over 1960. Public housing expenditures should expand even more in 1962, based on recent estimates of the Public Housing Administration.

Electric Utility Industry

The nation's electric power industry will reach new highs in output and generating capability in 1961, based on the latest semi-annual Electric Power Survey of EEI.

CAPITAL SPENDING BY BUSINESS
(For New Plant and Equipment)
(Billions of Dollars)



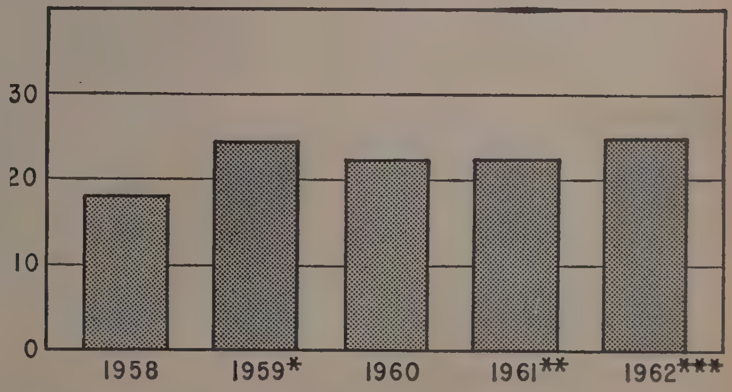
* SEC—Commerce Dept. estimate.
Source: Commerce Dept. and Securities and Exchange Commission.

NEW HOUSING STARTS
(Thousands of Units)

Year	No. of Starts
1958	1,209
1959*	1,554
1960	1,279
1961	1,325
Monthly**	
1960—July	1,182
—Aug	1,292
—Sept	1,062
—Oct	1,236
—Nov	1,216
—Dec	979
1961—Jan	1,105
—Feb	1,184
—Mar	1,317
—Apr	1,233
—May	1,220
—June	1,374

*New series, includes Alaska and Hawaii.
**Seasonally adjusted annual rate.
Source: Census Bureau, Dept. of Commerce.

GROWTH OF RESIDENTIAL CONSTRUCTION
(Billions of Dollars)



* New series includes Alaska and Hawaii.
** Mid-1961 estimate, BDSA, Dept. of Commerce.
*** EC&M estimate, mid-1961.
Source: Dept. of Commerce.

Output for the total electric utility industry in the United States (not including Alaska and Hawaii) is expected to reach 819 billion kwhr by the end of 1961—an increase of 7% over the 1960 output of 765 billion kwhr. Output will climb to more than one trillion kwhr by the end of 1964, the EEI study indicates.

The scheduled increase in generating capability during 1961 will bring the total power-producing capability of the industry to 188 million kw in December, 1961, or an increase of 7.4% above the actual capability in December 1960. By the end of 1964, capability is expected to reach 221 million kw, which represents an average annual increase of 6.2% for the five-year period from December 1959. For the 16-year period from the end of 1948 to the end of 1964, the average annual increase in capability is 8.8%.

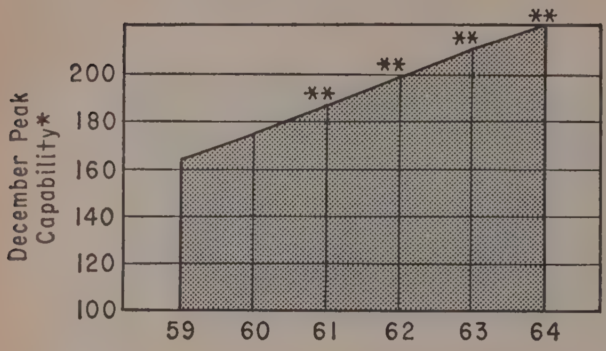
Total annual revenue of the electric power industry in 1961 will be in excess of \$13 billion, which constitutes its sales to about 60 million customers.

A major factor in the continuing growth of the electrical industry as a whole has been the foresight of the electrical utility industry to make long-range plans for adequate generating capability to meet the electric power needs of the nation. Not only is electric power available for today's needs—in mines, factories, commercial establishments, institutional buildings, in homes, for recreation, for streets and highways, etc.—but also for the nation's needs for tomorrow, and for the years ahead. Thus the manufacturers of electric utilization devices—motors, appliances, lighting equipment, electronic devices, air conditioners, electric space heating equipment, welders, etc.—are continuously assured of ample electric power for their products in any geographic location throughout the country.

Included in electric power generating capacity expansion is atomic electric power development. Already in operation are six atomic power plants, having a combined nominal rating of nearly 400,000

ELECTRIC POWER SUPPLY IN U.S.

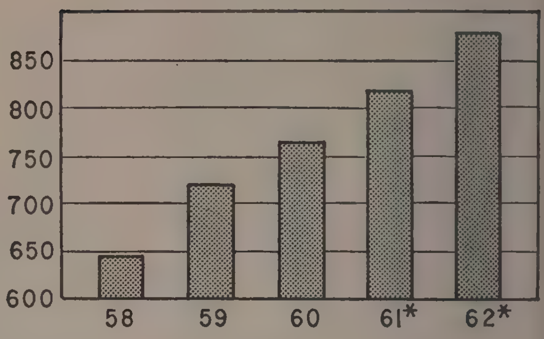
(Total Electric Utility Industry)



* Millions of kw.
** Actual for 1959-60, estimated for 1961-64 based on semi-annual Electric Power Survey by EEI.
Source: Edison Electric Institute.

ELECTRIC POWER PRODUCTION

(Billions of kwhr generated in U.S.)



* Forecasts by Edison Electric Institute.
Source: Edison Electric Institute.

kw; and during 1961 five additional plants with a combined nominal rating of about 330,000 kw are expected to go into operation. Also, there are ten other plants under construction, design or contract negotiation with a combined nominal rating of about 500,000 kw, and three more projects with combined nominal ratings of nearly 1,000,000 kw are in the planning stage.

In addition to the 24 projects referred to above, a large number of power systems are participating in nine other atomic research, development, and study projects which will undoubtedly lead to the construction of more reactors for electric power production. Also, one large manufacturer of electrical machinery and equipment has announced the availability of "package" atomic power plants.

With the tremendous capital investment which is required per kw of installed capability it is interesting to note that the cost per kwhr continues to drop, year by year (see table "Electric Energy for Residential Customers").

ELECTRIC ENERGY SALES

Year	Total Sales (Millions of Dollars)	Total Sales (Billions of kwhr)	Total Ultimate Customers
1958	9,734	569.2	56,208,491
1959	10,573	626.7	57,504,761
1960	11,516	683.2	58,869,766

Source: Edison Electric Institute.

ELECTRIC ENERGY FOR RESIDENTIAL CUSTOMERS

Year	Kwhr*	Total Cost*	Cost/kwhr*
1956 . . .	2,969	$77.19	2.60¢
1957 . . .	3,174	81.25	2.56
1958 . . .	3,366	85.16	2.53
1959 . . .	3,585	89.63	2.50
1960 . . .	3,827	94.53	2.47

*Annual averages.
Source: Edison Electric Institute.

SALES OF ELECTRIC LIGHT SOURCES

(Used for General Lighting)

	Incandescent		Fluorescent		Total
Year	Units*	Retail Value†	Units*	Retail Value†	Retail Value†
1956............	1,101	325	109	175	500
1957............	1,092	355	109	180	535
1958............	1,091	353	109	188	541
1959............	1,146	434	127	229	663
1960............	1,100	450	133	241	691

*Millions of lamps.
†Millions of dollars.
Source: Census Bureau, Dept. of Commerce.

The Lighting Industry

Lighting industry growth is, in general, paralleling that of electrical construction growth, except at a slightly higher annual growth rate. The industry comprises manufacturers of electric light sources, lighting equipment, and lighting equipment accessories—such as ballasts, lampholders, louvers and diffusers, etc.—from the standpoint of production. The industry may also be assumed to include the specifiers, sellers and installers, in its broadest sense.

The key element in electric lighting is the electric lamp, or light source. The major dollar volume, as well as number of lamps, continues to be for incandescent lamps (see table "Sales of Electric Light Sources"). In second place, and growing rapidly, is the fluorescent lamp. These two types of lamps only now have a combined annual retail value in excess of $700 million in 1961. In the five-year period from 1956 through 1960, sales of these two light sources only increased 38.5% for an average annual increase of about 7%.

Other light sources include mercury vapor, and electroluminescent. Mercury vapor lamp sales now total over $15 million annually at retail value, and this lamp is continuing to grow in popularity—for street and highway lighting, floodlighting, and large-area industrial areas. Electroluminescent applications are limited to areas where low brightness lamps are applicable, but more and more uses are being found for such lamps.

Lighting equipment sales continue to expand, aided by several interacting factors. The basic market for lighting equipment sales is inherent in two sources—new construction, and modernization, or relighting. As has already been noted, new construction work has again turned upward, following a slight decline in 1960. Modernization work, however, and especially relighting, is not moving ahead as rapidly as in previous years. There is a tremendous market for relighting, which has been analyzed in reports over the past few years, and is now estimated at some $7.5 billion for lighting equipment only. However, some architects and engineers are now making studies in depth of the economics of modernization versus new building construction. This would seem to indicate that there may be a developing trend to try to influence owners to tear down their old structures and build new ones rather than to invest in modernization of the old structure. Notwithstanding this possible trend, the fact remains that many thousands of old buildings exist which are underlighted, and will continue to be occupied. Thus these constitute a tremendous market for relighting. It is a market which must be developed and sold, and it is believed that this is a job that could most effectively be done through a cooperative promotional campaign sponsored by the entire electrical industry.

1961 LIGHTING EQUIPMENT DOLLAR VOLUME

(Used for General Lighting Purposes)*
(Thousands of Dollars)

Type of Construction Where Used	Value**
Total New Construction	**$524,716**
Private Construction	**371,461**
Residential (nonfarm)	123,750
Nonresidential buildings (nonfarm)	217,980
Industrial	61,740
Offices, warehouses and loft buildings	56,250
Stores, restaurants and garages	49,450
Other nonresidential buildings	50,540
Religious	19,987
Educational	10,764
Hospital and institutional	13,227
Social and recreational	4,687
Miscellaneous	1,875
Farm construction	3,185
Public utilities	25,871
Telephone and telegraph	14,534
Other public utilities	11,337
All other private	675
Public Construction	**153,255**
Residential building	2,400
Nonresidential building	87,950
Industrial	7,650
Educational	52,307
Hospital and institutional	7,000
Administrative and service buildings	14,423
Other nonresidential building	6,570
Military facilities	4,760
Sewer and water systems	2,445
Public service enterprises	2,240
Conservation and development	650
Highways (includes street lighting)	52,000
All other public	810
Modernization (relighting)	**55,000**
Total Lighting	**579,716**

*Does not include searchlights, automotive, aircraft or railway coach lighting, residential portable lamps, and similar types of lighting equipment not associated with building construction.

**Based on manufacturers' selling prices. EC&M estimate, mid-1961, based on Dept. of Commerce forecast for 1961 new construction at mid-1961.

LIGHTING EQUIPMENT VOLUME—1954 AND 1958

(Used for General Lighting, By Types)
(Thousands of Dollars)

SIC Code	Type of Lighting Equipment	Value* of Products Shipped 1954	1958
36421	Residential fixtures (excluding portable lamps)	89,312	117,992
36422	Commercial and institutional fixtures (excluding portable lamps)	114,283	165,472
36423	Industrial fixtures	62,393	60,457
36425	Floodlighting and area lighting equipment†	52,047	76,308
	Total value, general lighting equipment	**318,035**	**420,229**

*Manufacturers' selling prices.

†Does not include traffic signals, or mercury vapor ballasts.

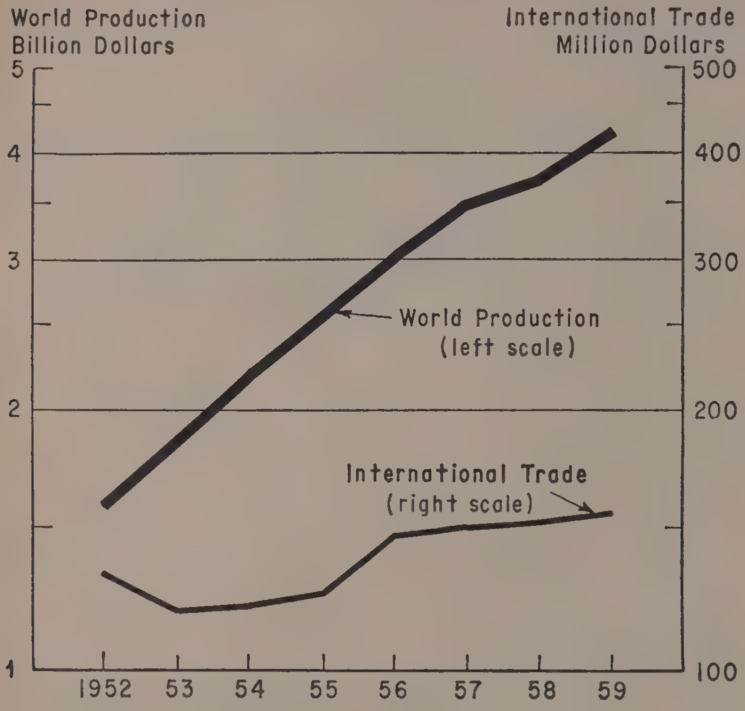
Source: Census Bureau, Dept. of Commerce.

Total lighting sales for 1961 are estimated at about $580 million (see table "1961 Lighting Equipment Dollar Volume"). If new construction estimates for 1961 are met, the lighting dollar volume for 1962 should increase to about $620 million—more, if relighting is successfully promoted.

The total lighting market subdivides into six basic types, classified according to end-use. It is estimated that the $580-million market estimated for 1961 breaks down into these six classifications about as follows, for both new construction and modernization, or relighting:

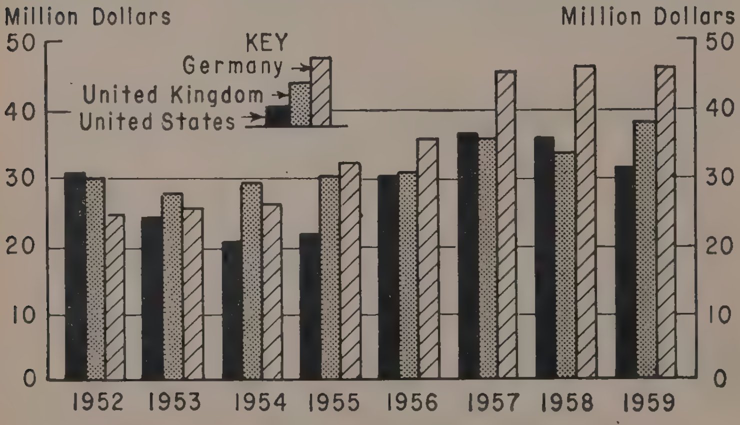
Residential lighting—$141 million. Included in this classification is commercial lighting equipment

WORLD PRODUCTION AND INTERNATIONAL TRADE OF ELECTRIC MOTORS 1952-59



Source: Electrical Equipment Div., BDSA, Dept. of Commerce.

EXPORTS OF ELECTRIC MOTORS BY LEADING WORLD SUPPLIERS 1952-59



Source: Electrical Equipment Div., BDSA, Dept. of Commerce.

such as fluorescent strip lighting, used for cornice and valance lighting, and incandescent downlights and lens units, etc., used for utilitarian and dramatic lighting effects in homes.

Industrial lighting—$80 million. Included in this category is also commercial lighting equipment, such as troffers and luminous ceilings which are used for many production areas in industry.

Commercial lighting—$160 million. This classification also includes such equipment as industrial reflectors, ornamental residential luminaires (as in a restaurant), floodlights and spotlights, etc.

Institutional lighting—$132 million. Included in this classification is much custom-built equipment, both utilitarian and decorative, and in general the mass quantity is identical to the "commercial" classified equipment.

Street and highway lighting—$52 million. This is standard street lighting luminaries of all types—mercury vapor, fluorescent, incandescent—and also includes poles, brackets, newels, etc.

All other lighting—$15 million. This covers lighting equipment and end-use applications that are not covered in the above five classifications.

The dollar volumes indicated above are estimates, based on new construction estimates and modernization work for 1961, and assume continuing and effective industry promotion of the current IES lighting recommendations for quantity and quality as adopted in 1958.

World production of electric motors has risen sharply in recent years. Value of output in 1959 was an estimated $4.2 billion, almost triple the 1952 output of $1.6 billion, according to a recent Dept. of Commerce study and report. This is a rate of increase averaging 18% a year.

International trade in electric motors during this period lagged far behind production (see Chart). The percentage of world output entering international trade channels dropped from 8.4% in 1952 to an estimated 3.6% in 1959.

The United States, the United Kingdom, and West Germany combined account for an estimated 75% of total world exports.

Increasing world competition has resulted in a shift in the relative positions of the three major world suppliers (see Chart). In 1952, the U. S. supplied more than 50% of the export market, and by 1959 this had dropped to about 23%.

This example is presented to show that the U. S. electrical industry is now in a world market, and must take this into account—first, for expansion of its markets through export; and second, from a competitive standpoint in supplying our domestic needs.

One approach of U. S. firms to meet this situation is the investment in new plant and equipment in other countries, by many U. S. companies. Such investments this year will total $4.5 billion, up more than 20% from 1960, according to a Dept. of Commerce estimate.

Planning an Industrial Electrical System

Electrical design and installation techniques selected for the new Bausch & Lomb eyeglass-frame plant at Chili, N. Y.

By A. A. Tseng, *Electrical Engineer, Stone & Webster Engineering Corp., Boston, Mass.*

A WELL-DESIGNED electrical installation largely depends on a full understanding of the present and future needs of each particular plant. Moreover, industry data, concerning the products manufactured, serve as a barometer for the expected growth of business and plant facilities.

In the case of an eyeglass-frame plant, industry statistics indicate that one in every four persons in this country wears eyeglasses, and a one-to-three ratio is reached when sunglasses are included. These facts represent a substantial part of the business of Bausch & Lomb, Inc., Rochester, N. Y.

Stone and Webster has recently completed Bausch & Lomb's new eyeglass-frame plant, located at Chili, N. Y. Products that will be manufactured in this 250,000 sq ft plant include spectacle frames for Bausch & Lomb sunglasses, dress and industrial eyewear frames, and all types of eyeglass frames.

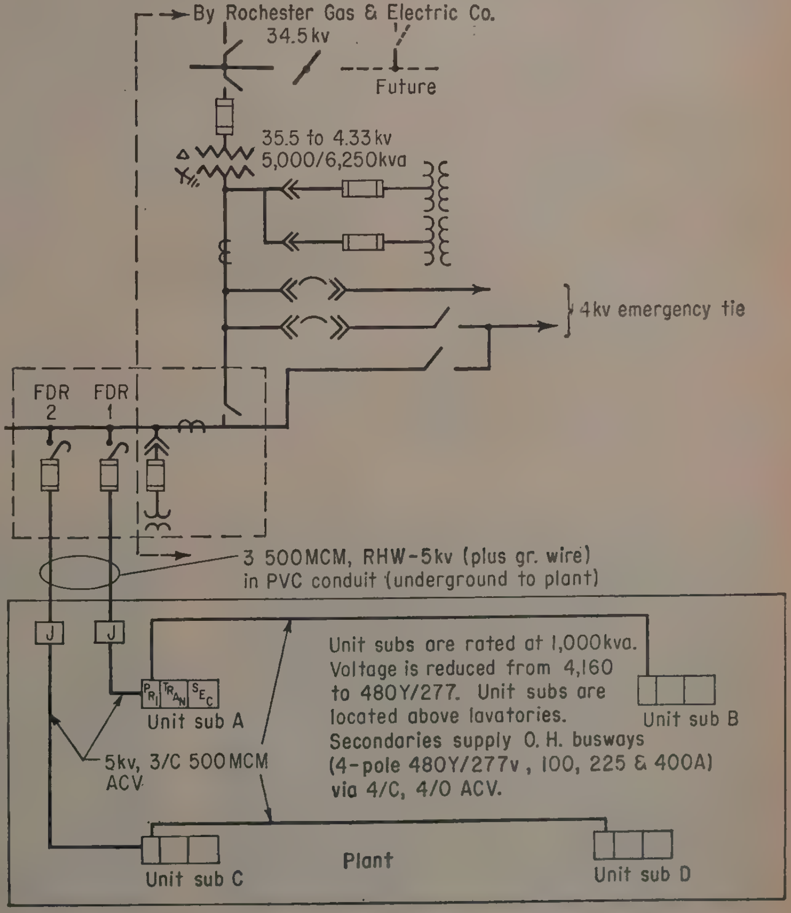
The life of an industrial enterprise depends on its margin of profit per year. To attain maximum profits, economic conditions must be closely observed during initial plant layout. Furthermore, the plant design must conform to safety codes. And the plant design must be completed on schedule and at minimum cost to lower capital charge-offs; yet it should be flexible enough to permit quick layout changes needed for new products.

This article describes how electrical facilities have provided economical, safe and flexible layouts to meet the unusual requirements at the new Bausch & Lomb plant.

Problem and Solution

The plant layout consists of 12 production areas and a large warehouse, which also serves as a distribution center. Production and distribution areas are in a windowless 510-ft by 400-ft building, with a ceiling height of 20 ft and truss clearance of 16 ft. Attached to the production building are extensive office facilities, a steam plant, locker rooms, loading and shipping docks, and a cafeteria with a 400-seat capacity.

To provide adequate illumination for approximately 1000 employees in a windowless plant covering



Unit subs are rated at 1,000kva. Voltage is reduced from 4,160 to 480Y/277. Unit subs are located above lavatories. Secondaries supply O. H. busways (4-pole 480Y/277v, 100, 225 & 400A) via 4/C, 4/0 ACV.

FIG. 1—One-line diagram shows basic power distribution. Two gang-operated, fused load-break switches, installed in an outdoor cubicle, provide 4160-volt primary supply to four 1000-kva unit substations in the plant. Underground cables are rated at 5 kv and are installed underground in PVC conduit to plant. Primary wiring in the plant extends to unit subs via exposed ACV steel, interlocked armored cable. Over 18,000 ft of plug-in busway is supplied from the four substations in the plant.

nearly five acres required an average lighting intensity of 75 fc for working areas, and intensities up to 300 fc for special needs.

Field surveys and studies were made with Bausch & Lomb staff engineers to determine the load factor for the new plant, based on data from existing plants and the planned production schedules. There are about 1000 440-volt motors and furnaces and 1200 110-volt electrical devices connected to the electrical system, with a total connected power and lighting load of 5500 kw.

Locating each of four 1000-kva substations above a lavatory satisfied several objectives. Substations would be nearer load centers; production areas would be clear; overhead steel supports would be kept to a minimum; and feeders to 18,000 ft of plug-in busways could also be kept overhead with minimum interference.

Early Equipment Orders

Time was critical not only because of the April 1961 completion date, but because the power equipment had to be delivered by November 1960 to supply the light and boiler heating load during winter construction. The construction schedule and budget did not provide for temporary work. Consequently, plans were accelerated so that, by early August, orders were being made for long-delivery items such as transformers, switchgear, and larger secondary distribution equipment.

WORKING FROM SCAFFOLD, electrician attaches 3-pole 50-amp busway to roller hangers. Welded studs secure hangers at 5-ft intervals. Airplane messenger wire, seen to right of busway section, provides side-tension control.

Pre-engineered power equipment packages have many advantages. They are easy to order and require only one specification for the complete power package. Moreover, there is no need to order bits and pieces from a number of suppliers, and paper work is kept to an absolute minimum. Units are completely assembled, pre-tested before delivery, and are easy to install. As a result, equipment is moved into place, the incoming and outgoing lines are connected, and the system is ready for operation.

The following "basic building blocks" were ordered, based on their merits and expected construction savings resulting in part from sound engineering practices:

1. An outdoor 4160-volt power switching center that connects directly to the adjacent metering and switching cubicles purchased by the local power company. Each cubicle contains a gang-operated, fused, load-breaking switch.

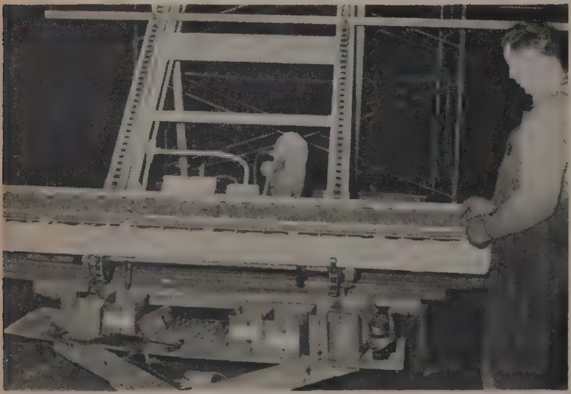
2. Four 1000-kva industrial-type power-center units. Each unit is an integrally packaged substation, consisting of a transformer with a 4160-volt primary and seven secondary switches. These units are designed for installation close to or within a load area. Kilowatt demand recorders are provided to record and measure various department peak demands for production and scheduling purposes.

3. Interlocked, armored, galvanized steel, varnished-cambric cables on standard aluminum ladder trays for indoor portions. It was noted that only this type of cable bears the UL label, and the local inspectors were consulted to insure approval of this type of installation.

4. Factory pre-cast concrete manholes and handholes for underground cable installation.

5. Twenty- to 30-ft-long plastic conduits with end couplings for underground installation. Considerable labor and time were saved by using directly buried conduits. Records indicate 2000 ft of 3-in. and 4-in. conduits can be installed in 24 man-hours.

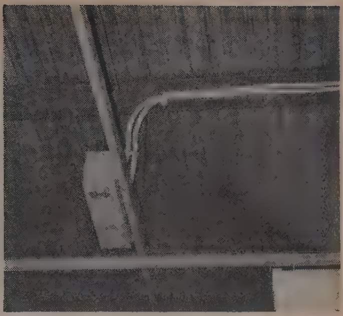
6. New "one-bolt," 3-phase, 4-wire, plug-in 480-volt busways throughout all production areas. Proper selection of standard lengths and fittings was made to fit the production layouts. The entire 480-volt busway system was assembled 17 ft above ground by a five-



FIXTURES AND BUSWAYS were prepared at ground level, then raised to rolling platform by using a pushbutton-controlled conveyor-type hoist. This method reduced labor costs and cut installation time for fixtures and busways. The entire 480-volt overhead busway system was installed by a 5-man team at a rate of 200 to 240 ft per day.

TWO ELECTRICIANS for Horacek-Hayden Inc., Rochester, N. Y., receive 8-ft fluorescent fixture from motorized conveyor. As each fixture is installed and connected, another unit is readied into position on the conveyor by a mechanic at ground level. Scaffolds and conveyor are both provided with casters so equipment can be readily moved.

LIGHTING SYSTEM was installed and energized in early construction stages. Here workmen are in process of pouring concrete floor slab under ideal lighting conditions. This procedure eliminated the need of extensive temporary lighting found on most jobs.



COMPLETE INSTALLATION of fluorescent fixtures and busway is shown. Fixtures plug into 277/120-volt 3-pole 50-amp busway. In the top part of photo, the mechanically held contactor (shown in Fig. 2) plugs into 480Y/277-volt 4-pole power busway. Interlocked armored cables extend into control panel.

man team at a rate of 200 to 240 ft per day.

Fig. 1 shows a one-line diagram of the plant power distribution system.

Accompanying photos show the general lighting arrangement, which provides an average lighting intensity of 75 fc. In general, the plant is illuminated by 277-volt, 8-ft Power-Groove fluorescent lamps with intermediate 120-volt, 40-watt, rapid-start fluorescent night lights which cannot be switched locally.

Fig. 2 indicates typical control arrangements and lighting distribution used throughout the plant.

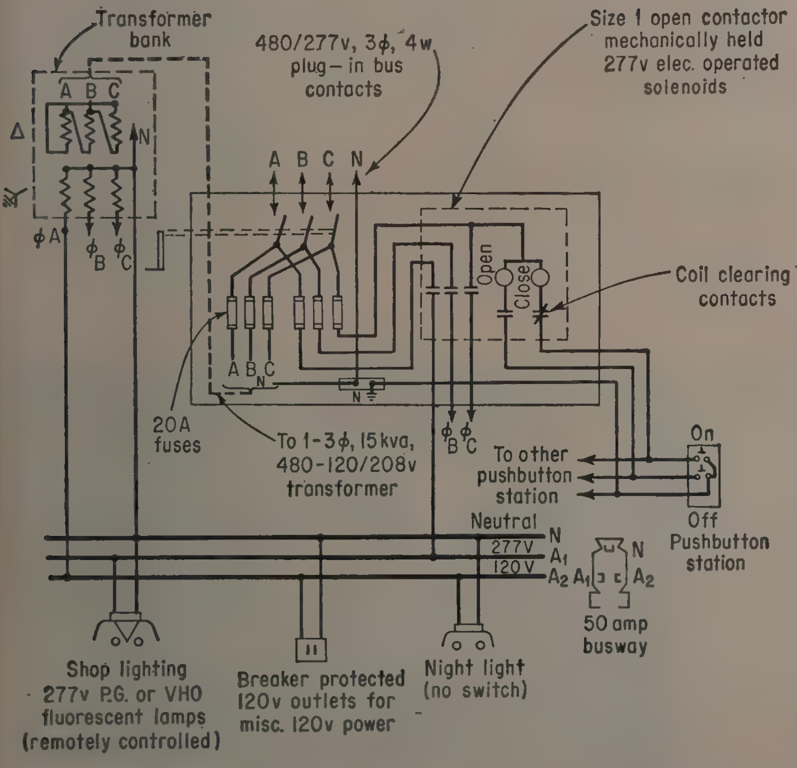

Transformer bank
Δ
Y
A B C
N
φA
φB
φC
480/277v, 3φ, 4w plug-in bus contacts
A B C N
Size 1 open contactor mechanically held 277v elec. operated solenoids
Open
Close
Coil clearing contacts
A B C N
N
20A fuses
To 1-3φ, 15kva, 480-120/208v transformer
φB φC
To other pushbutton station
On
Off
Pushbutton station
Neutral
277V
120V
N
A1
A2
A1
A2
N
50 amp busway
Shop lighting 277v P.G. or VHO fluorescent lamps (remotely controlled)
Breaker protected 120v outlets for misc. 120v power
Night light (no switch)

FIG. 2—Unique control arrangement operates 277-volt shop lighting in the new Bausch & Lomb plant. Note that typical runs of 3-pole 50-amp busway provide circuits for both 120- and 277-volt circuits. Each 15-kva dry-type transformer provides 120-volt power for three 50-amp busways.

At each end of the 3-phase, 3-row fluorescent fixtures, there is one pushbutton station. These stations have been located for convenient control of plant lighting by security and supervisory personnel. They provide the momentary current required to energize either the "on" or the "off" coils of the mechanically held contactors plugged along the 480-volt plug-in buses. No power is wasted by keeping the contact closed.

Supplementary lighting is furnished by 40-watt fluorescent strip lights over quick-pick racks and standard shelves in the warehouse area so that small print on the products can be easily read by personnel.

Throughout the warehouse area, 277-volt, 8-ft Power-Groove fluorescent lamps with intermediate 120-volt, 40-watt rapid-start fluorescent night lights, as shown on Fig. 2, provide an average lighting intensity of 30 fc.

The following proposals were selected for cost comparisons.

1. Use of conventional wire and conduit for supplying the very-high-output fluorescent fixtures fed from conventional 208Y/120-volt lighting transformers, and lighting cabinets with necessary 120-volt outlets at 5-ft intervals to supply miscellaneous power.
2. Use of factory prefabricated wiring troughs for support of 277-volt lighting fixtures with separate transformers for 120-volt outlets at 5 ft intervals.
3. Use of a 277/120-volt, 3-wire busway system as shown on Fig. 2.

(Continued on page 223)

How to plan . . .

Outdoor Substation Maintenance

Practical, step-by-step inspections of substation equipment are the key to trouble-free operation and uninterrupted service.

By Robert J. Lawrie

IF PROPER maintenance of an outdoor substation is neglected, even the most extensive in-plant electrical preventive maintenance program would be for naught. Because substation equipment is ruggedly built and can operate for several years with only a minimum of maintenance, some engineers tend to take this equipment for granted. And, sooner or later due to the lack of proper maintenance, some component will fail, very likely causing extensive damage and a lengthy downtime.

Yet effective maintenance of an outdoor substation, which would insure its reliability, is easily accomplished after careful study and planning.

One of the first considerations is the question, "Who is qualified to inspect and perform maintenance on the outdoor substation"? After the inspection procedures set forth in this article have been reviewed, it will be evident that an alert plant electrician can perform substation inspections. However, actual work performed in the substation, including routine preventive maintenance, should be accomplished by trained high-voltage electricians. If none is available within the company, a reputable substation maintenance contractor should be called in.

Effective substation maintenance can be planned in three interrelated phases. They are: (1) inspections, (2) records, (3) routine preventive maintenance procedures.

This article deals mainly with the inspection phase, using, as an example, an outdoor substation located at Special Metals Inc., New Hartford, N. Y., as a guide. As inspection procedures are being planned and written for a specific outdoor substation, the number and kind of records required will become evident. Routine preventive maintenance procedures will be discussed briefly later on.

Some engineers feel that a daily inspection of this all-important equipment is necessary. And, if it is at all possible, daily inspection is highly recommended. But frequency of inspection depends on the complexity, type and age of the equipment as well as the prevailing weather conditions. Many engineers feel that a weekly inspection is minimum, with the reservation that the substation be shut down at least once a year and given a thorough testing and inspection.

When planning inspection procedures, consult the manufacturer of the station equipment to be sure all details are covered. Or consult the local power company. In many

SAFETY is of paramount importance when inspecting the substation. Upon entering the substation, the inspector's eyes should travel from the incoming lines following conductors through switches and superstructure watching for any arcing or burning.

cases, they will gladly send an expert to assist in setting up the inspection schedule.

To become familiar with the substation equipment, make a one-line diagram such as the accompanying sketch. This modified one-line diagram of a typical substation contains numbers that refer to the corresponding numbered photos and to inspections outlined in text.

Because of the large variety of outdoor substation equipment manufactured, these inspection procedures may vary somewhat. However, steps may be added or deleted.

1. Safety

It is impossible to overemphasize the importance of personal safety when dealing with high-voltage equipment. Upon entering the station, the inspector's eyes should travel from the incoming lines following conductors through switches and superstructure watching for any arcing or burning. Using a pair of high-powered binoculars, he can thoroughly inspect any part of the system from a safe distance. The inspector must double-check his every move when in the substation and always be alert. An inadvertent move might not only disrupt the substation and plant but also may endanger his life.

2. Lightning Arrestors

a. Look for cracked insulators, dirt or foreign material and loose connections.

b. Be sure ground connections are tight (if accessible).

3. OCB Isolating Switch

a. Look for cracked insulators, dirt or foreign material, loose connections and oxidation at the switchblades.

b. Clean any dirt or foreign material from switch-operating mechanisms. (Because all substation isolating switches cannot be operated while carrying current, these switches should be padlocked closed.)

c. Be sure operating-mechanism parts are tight.

4. Oil Circuit Breaker (OCB)

a. Look for cracked insulators, dirt or foreign material and loose connections.

b. Be sure ground connections are tight.

c. Record bushing oil levels (six).

d. Record tank oil levels (three).

e. Record air-reservoir pressure. (Many OCBs are pneumatic operated.)

f. Look for possible air leaks.

g. Make a visual inspection of control-cab wiring and air-compressor motor. (Lubrication schedule for this motor can be placed inside control cab.)

h. Look for any oil leaks (at gasketed manhole covers or oil valves).

i. Watch for excessive corrosion or rust.

j. Every six or twelve months, take oil samples from each tank. (Oil samples may be sent to a testing laboratory for testing of moisture content, dielectric strength and sludging.)

5. Superstructure, Overhead Conductors and Station Housekeeping

a. Look for any foreign material in superstructure, such as bird nests or ice. Also look for cracked insulators, dirt or loose connections.

b. Be sure superstructure ground connections are tight.

c. Check all substation floodlighting.

d. Be sure that the substation is clean. Remove any oil barrels or discarded material lying on the ground. (Substation grounds should be covered with a layer of gravel; if weeds are growing, they should be killed with chemicals.)

6. Transformer Primary Isolating Switch

a. Look for cracked insulators, dirt, or foreign material and loose connections.

b. Clean any dirt or foreign material from switch-operating mechanisms.

c. Be sure operating mechanism parts are tight.

7. Power Transformer

a. Look for cracked insulators, dirt or foreign material, and loose connections.

b. Be sure ground connections are tight.

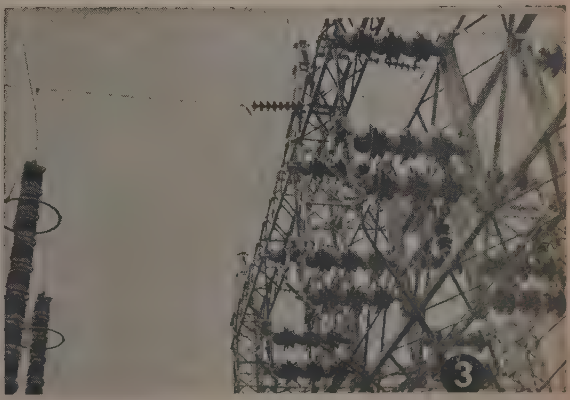
c. Record transformer tank oil level.

d. Record bushing oil levels (3) or (6).

e. Record oil and winding temperatures.

f. Record pressure-vacuum gage reading.

LIGHTNING ARRESTORS protect substation equipment from transient voltage surges caused by lightning discharges. Look for cracked insulators, dirt and loose connections. In many cases, lightning arrestor failures have been traced to a poor ground connection. Be sure ground connections are tight.



OCB ISOLATING SWITCHES cannot be operated under load. These switches should be padlocked closed. Look for oxidation at the switchblades as well as cracked insulators and loose connections. High-voltage rubber gloves should be worn if this switch must be operated.

g. Check pressure-relief diaphragm (if accessible).

h. Check for oil leaks (at gaskets and oil valves).

i. Inspect cooling fans (when used).

j. Every six or twelve months take oil samples.

8. Outdoor Metalclad Switchgear (Panel Side)

Cubicle No. 1—Main air-circuit-breaker control and metering.

a. Look for dirt and foreign material, loose or burned control wiring and excessive rust or corrosion.

b. Check cubicle illumination, signal lamps and cubicle strip heaters.

c. Record meter readings.

Cubicles No. 2, 4, 5, 6, 7—Circuit breaker control and metering.

(Repeat inspection as described for cubicle No. 1.)

Cubicle No. 3—Battery charging equipment.

(Repeat inspection as described for cubicle No. 1) plus: Check charging current. (As the rectifier ages, the control rheostat must be adjusted to maintain proper charge-current value.)

9. Outdoor Metalclad Switchgear (Circuit-breaker Side)

Cubicle No. 1—Main air circuit breaker and control wiring.

a. Look for dirt and foreign material, loose or burned control wiring and excessive rust or corrosion.

b. Look for any indication of arcing (burning odors or flashing).

Cubicle No. 2—Metering transformer compartment.

(Perform inspection as described for Cubicle No. 1.) *Caution*—It may be dangerous to open this compartment. Before inspecting this compartment, consult the manufacturer or a high-voltage expert to be certain that all safety interlocks are installed.

Cubicle No. 3—Storage batteries for CB auxiliary trip power.

a. Look for dirt and foreign material, loose or burned control wiring and excessive rust or corrosion.

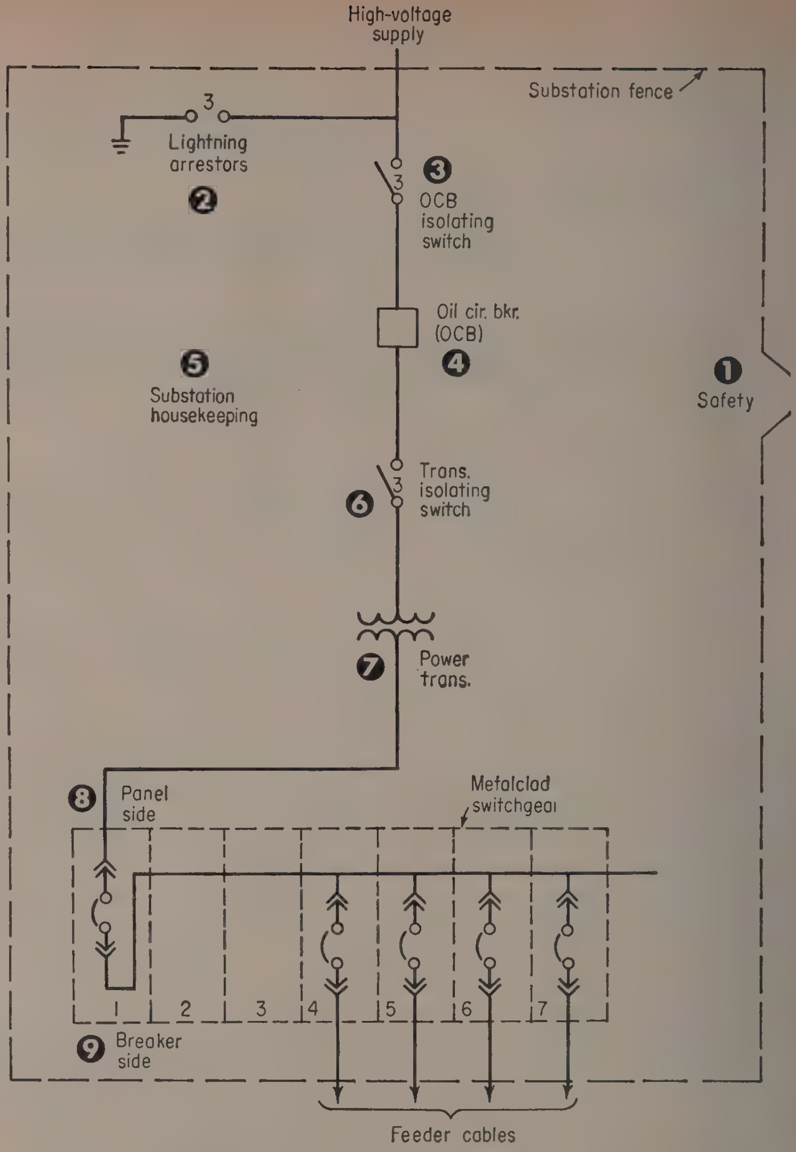
b. Select a cell as a pilot. Record temperature and specific gravity of this pilot cell.

c. Once a month record temperature and specific gravity of each cell.

d. Check battery water level.

Cubicles No. 4, 5, 6 & 7—Feeder circuit breakers.

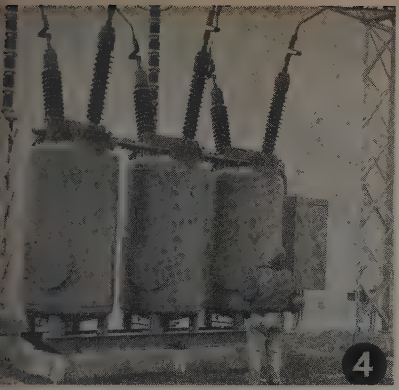
(Perform inspection as described for cubicle No. 1.)



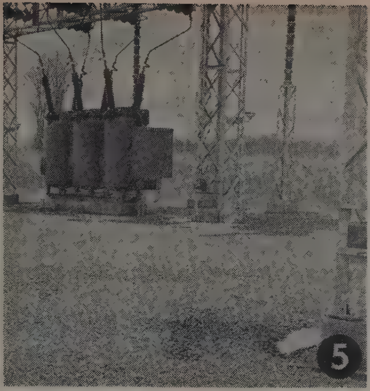
TYPICAL SUBSTATION layout is shown in a modified one-line diagram. On the diagram, numbers refer to the inspection procedures outlined in the text and to the corresponding numbered photos. These inspections can be performed by an alert plant electrician.

While inspecting the substation, the electrician may spot a loose connection or excessive corrosion. In addition, routine preventive maintenance procedures must be performed. Who qualifies to accomplish these procedures? In some companies, engineers assign this work to plant electrical men. These engineers know how to shut down their substation safely and know how to prepare the substation for maintenance. And, because of the unique characteristics of high-voltage apparatus, they have made certain that the selected men are well trained and fully qualified to perform substation maintenance.

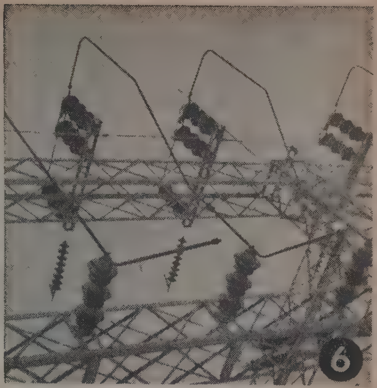
On the other hand, other engineers have found that calling in an outside contractor is the most efficient and economical way to maintain the substation. Main advantages gained in subcontracting substation maintenance are: (1) In many instances it is cheaper. Plants that hire trained high-voltage electricians usually find that they command a high wage. In some areas certain ordinances require that not less than two men perform this work, further increasing costs. Also, an inefficient situation occurs when substation maintenance is not extensive enough to keep these men busy; (2) Assurance that the ex-



OIL CIRCUIT BREAKER (OCB) requires extensive inspection for proper maintenance. Here, a plant electrician takes bushing oil-level readings. He'll also record tank oil levels and the air reservoir pressure and look for oil leaks and excessive corrosion.



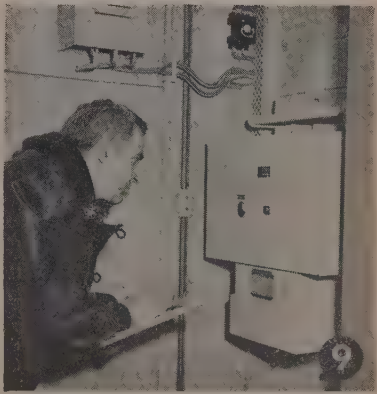
SUPERSTRUCTURE, overhead conductors and station area receive a thorough visual inspection. Look for foreign material such as bird nests or ice in the superstructure. Substation floodlamps should be tested. Substation area should be kept clean; kill weeds with chemicals.



TRANSFORMER ISOLATING switch is three pole, group operated with horngaps. Look for cracked insulators and loose connections. Clean and lubricate operating mechanism at intervals. Any oxidation at the switchblades should be removed at the maintenance shutdown.

POWER TRANSFORMER, rated 3750 kva, 115 kv/13.2 kv, is being inspected by plant electrician. Transformer-tank oil level and temperature, bushing oil levels, and pressure-vacuum gage readings should be recorded for future reference and comparison.

OUTDOOR SWITCHGEAR inspection (panel side) includes recording meter readings, and checking cubicle illumination, signal lamps and strip heaters. Here, a plant electrician makes a visual inspection for excessive rust or corrosion and loose or burned control wiring.



OUTDOOR SWITCHGEAR (CB side) inspection is similar to the panelside inspection. In addition, the plant electrician checks for any indication of arcing (burning odors or flashing). The number of breaker operations is automatically tallied on front of the breaker.

pensive substation equipment will get expert care leading to longer equipment life; and (3) The possibility of a power interruption, due to faulty substation equipment, is greatly reduced. And, in most cases, if trouble in the substation does occur, the substation maintenance contractor will immediately send an expert troubleshooter with proper equipment and spare parts. In addition, the contractor will analyze the substation maintenance requirements, plan the maintenance program and perform all necessary preventive maintenance.

The following is a partial list of routine preventive maintenance procedures for the outdoor substation.

1. Safety—check all ground conductors; measure resistance of ground circuit. Check substation fence, gate locks, high-voltage signs and safety interlocks.
2. Tighten all superstructure bolts, high-voltage cable connections and busbars.
3. Tighten transformer, OCB, and air-circuit-breaker fittings.
4. Test oil samples with portable tester.
5. Make insulation-resistance tests on high-voltage cable and buses. Make power-factor tests on transformer and OCB bushings and on isolating-switch insulators.
6. Test all relays and control circuits for the OCB, transformers and components in the metalclad switchgear.
7. Inspect, clean and adjust isolating switches and operating mechanisms.
8. Check OCB contact resistance with a "Ductor" or similar device. Inspect interior of OCB and perform pertinent tests.
9. Inspect interior of transformers and perform pertinent tests.
10. Inspect and test air circuit breakers. Perform timing and travel tests, contact inspection and lubrication.

RAPID TRANSITION from brilliant outdoor illumination to darkness of tunnel would result in momentary blindness to the motorists while waiting for eyes to dilate sufficiently to adopt to poorer seeing conditions. Relay control panels are well-recessed beneath arrow.

Tunnel Lighting

High-output fluorescent lamps, with cycling controlled by photocells and astronomic clock auxiliaries, are installed in highway tunnel to produce 50 footcandles of portal intensity. Installation of this, plus mercury-vapor approach system, was by Newbery Electric.

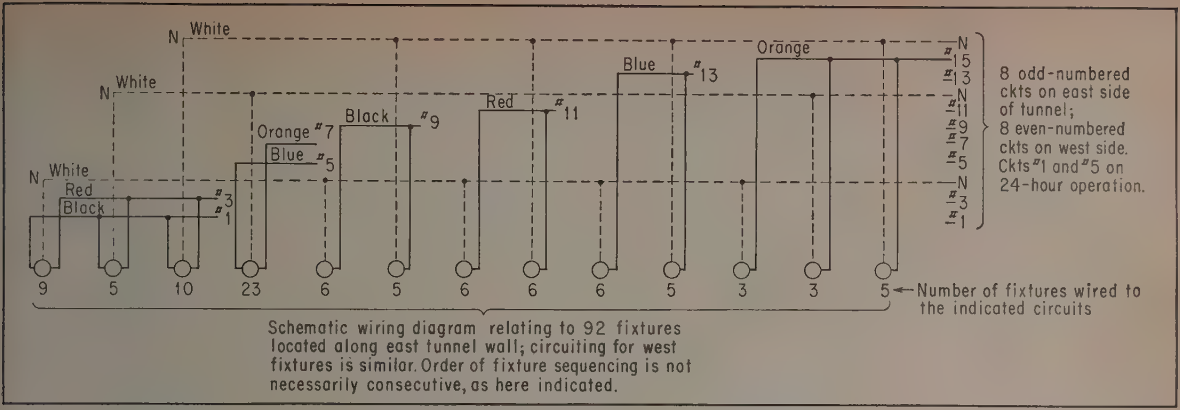
By H. Stead, *Traffic Supervisor, Arizona Highway Dept.*

FAST EMERGENCE from dark tunnel to bright sunlight would create adaptation problem in reverse. Both conditions point to importance of high-level artificial illumination just inside portals, although intensities may be gradually lessened as motorists proceed inward toward center of tunnel and pupils of eyes have time to dilate to compensate for reduced lighting values.

ARIZONA'S legendary sunshine, as that State's Chamber of Commerce will gladly point out, offers a brilliant solution for weather-weary tourists seeking a pleasant winter haven.

It does, however, also create occasional problems. As, for example, in the design of tunnel lighting—where higher outdoor footcandles accentuate the relative darkness of tunnel portals entered at high speeds.

To illustrate, consider Mule Pass in Cochise County. Located close to the Mexican border between Tombstone and Douglas on U. S. 80, this recently completed tunnel improves safety and cuts traveling time by eliminating a hazardous section of narrow, twisting roadway across a 6000-ft mountain ridge. Extending 1400 ft in length, the tunnel has a crown-to-roadway


N White
N White
N White
Red
Black
#3
#1
Orange #7
Blue #5
Black #9
Red #11
Blue #13
Orange
N
#15
#13
N
#11
#9
#7
#5
N
#3
#1
8 odd-numbered ckts on east side of tunnel; 8 even-numbered ckts on west side. Ckts #1 and #5 on 24-hour operation.
9
5
10
23
6
5
6
6
6
5
3
3
5
Number of fixtures wired to the indicated circuits

Schematic wiring diagram relating to 92 fixtures located along east tunnel wall; circuiting for west fixtures is similar. Order of fixture sequencing is not necessarily consecutive, as here indicated.

DAYTIME—NIGHT-TIME lighting intensities and circuiting arrangements are variable; requiring circuits 1, 2, 5 and 6 to be kept in operation continuously, with others switched on or off as required. All fixtures are 2-lamp units; circuits 1 through 4 controlling only one lamp per fixture; remaining circuits controlling both lamps.

With H. O. Lamps

clearance of 23 ft; a gradient of 6½%; and a width of 42 ft that contains twin walkways plus three traffic lanes separated by 18-in. whistle stripes.

In designing the lighting for this tunnel, the problem of eye adaptation related to fast transition from brilliant sunlight to a relatively dark interior was fully appreciated. Analysis of tunnel accidents indicated that the first 500 ft inside portal entrances were critical areas, inasmuch as objects in paths of moving cars could not be clearly discerned *unless* high levels of artificial illumination were provided. As cars proceed inward and motorists' eyes gradually dilate to adjust for reduced lighting levels, high portal illumination can be progressively lessened. But, when cars are entering a tunnel at speeds above 40 mph (as is the case at Mule Pass), initial portal intensities of 50 fc were considered to be minimum objectives.

50-FC Portal Intensities

As actually obtained, daylight intensities for the first 150 ft inside each of these portals is 50 fc, this level dropping to 25 fc for the next 75 ft, 16 fc for the next 75 ft, and 11 fc for the central 800-ft distance. Brightness values of fixtures approximately 7½ footlamberts.

Since the tunnel carries 2-way traffic, spacing of fixtures at both portals is symmetrical; such spacing being progressively 6½, 11 and 16 ft along each side of the tunnel for the distances noted above, then continuing at 16 ft intervals (but with fixtures staggered from side to side of the tunnel) for the remaining central section.

Fixtures are high-output 2-lamp 6-ft units; each 100-watt T-12 cool-white rapid-start lamp provided with a separate ballast, and each 1000-ma high-power-factor ballast designed for multiple 115-volt circuiting and for minimum winter temperatures of 20 degrees below zero.

Fixtures are of all-aluminum construction, curved housings extruded, end caps cast, and polished Alzak reflectors sprung into holding grooves. When access to terminal blocks and ballasts is desired, reflectors may be quickly removed by manual squeezing.

These fixtures are also equipped with curved, ribbed, clear acrylic plastic covers; door frames sealed by neoprene gaskets, secured by separable stainless-steel hinges and spring-loaded catches, and capable of being completely detached if so desired. Lampholders are double-contact heavy-duty devices recessed into end caps; one holder being compressible to permit fast, secure relamping.

Since extreme natural-artificial lighting ratios are absent after dark, and high portal illumination is therefore less critical, night-time circuiting provides for a lower, uniform, portal-to-portal level of approximately 6 fc with fixture brightness values averaging 2½ footlamberts. This is accomplished by using only one lamp in every fourth fixture for the first 138 ft inside each portal, one lamp in every third fixture for the next 95 ft, and only one lamp in each 2-lamp fixture for the central 800-ft section.

Location of fixtures reflects considered forethought, because it was deemed advisable to keep lighting units away from the tunnel's crown area, where smoke from diesel trucks would necessitate more frequent cleaning. Yet a location too close to outer walls would simultaneously lower fixtures to points where they conceivably could be struck and damaged by tall truck bodies or flapping canvas tarpaulins.

Their present location, above curb lines at heights of 14-14½ ft, is therefore conducive to greater accessibility, maintenance ease and fixture safety.

Since these mounting heights are relatively low, it then became important to select fixtures which would combine low-brightness values and minimum glare characteristics with high light output. Other desirable objectives included long lamp life and reduced energy consumption; all of these factors

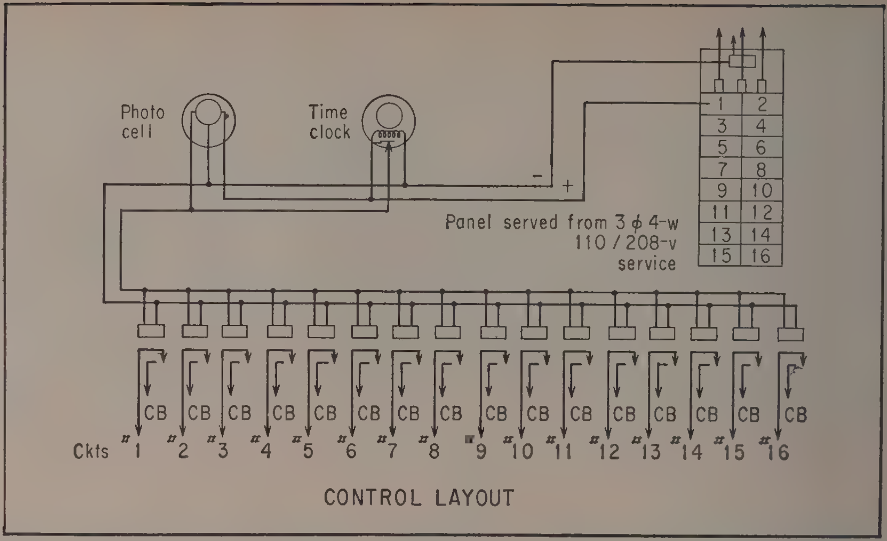


Photo cell
Time clock
-
+
Panel served from 3 φ 4-w 110 / 208-v service
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
CB
Ckts #1 #2 #3 #4 #5 #6 #7 #8 #9 #10 #11 #12 #13 #14 #15 #16
CONTROL LAYOUT

LIGHTING CIRCUIT CONTROL is by relay-activated breakers, cycling being regulated by operation of either photocell unit or astronomic clock. Photocell is aimed due north, while clock is synchronized with exact latitude of tunnel location. Should manual control of lighting be desired, direct switching is possible as well.

suggesting the use of high-output fluorescent lamps.

With fixture housings and ballasts weighing approximately 55 lb per 6-ft assembly, units are supported solidly by brackets, which in turn are anchored via galvanized lock washers and nuts to similarly rust-proofed studs driven into concrete walls by means of power fastening tools. And to direct maximum light downward to the roadway, fixtures are inclined downward 45 degrees from the horizontal.

Photocells and Relay Control

For control purposes, lamps are grouped into 16 circuits; each circuit serving approximately 24 lamps; only a fourth of these circuits being used for night-time service. Control is by masonite-mounted mercury relays rated at 60 amps each and normally de-energized during daylight hours. Switching of relays is regulated by a photocell unit oriented to due north. And for auxiliary control purposes, the relay cabinet is also equipped with a manual switch plus an astronomic spring-action clock having carry-over characteristics synchronized for the exact latitude of the tunnel (31 degrees 25 minutes). Normally closed contacts of multiple relays are protected by fuses placed on coil and load sides as well, while coils are additionally protected by the existence of lightning arresters.

Wiring for lighting fixtures is carried through tunnel walls via two 2-in. galvanized rigid steel conduits, each conduit serving one side of the tunnel, that is, 92 2-lamp fixtures.

Junction boxes are installed behind each fixture location. Connections between JBs and fluorescent fixtures are by means of flexible waterproof conduit and fittings and, in cases where angle fittings attached to these flex sections do not establish solid grounding bonds, the waterproofing insulation is removed to insure that protection.

Connections within junction boxes (between No. 6 feeders and No. 12 fixture leads) are established via split-bolt copper connectors insulated by successive layers of cambric tape, plastic electric tape and compound, while connections between lead wires and ballasts within fixtures are made by splicing and soldering, then insulating with plastic and friction tape. Feeder wires are formed into 10-in. slack loops in each junction box to facilitate splicing and permit subsequent reconnection and recircuiting of fixtures if desired.

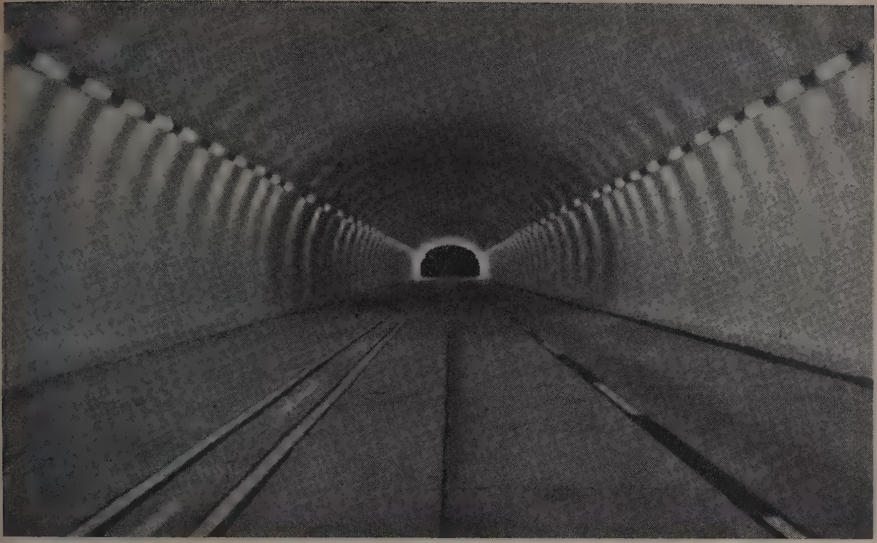
Mercury Approach Lighting

In addition to lighting inside the tunnel proper, illumination is also provided for exterior approaches by 400-watt 20,000-lumen mercury-vapor lamps housed in OV-35 Type III distribution luminaires supported by 30-ft Type X steel poles equipped with 8-ft upsweep mast arms, and serviced through underground multiple-lamp ballasts. Flashing or pulsating 1-way amber light heads likewise are installed along approach sections, where new roadway alignments depart from the old, to warn motorists of this new construction.

In this approach-lighting installation, underground service between pullboxes is through asbestos-cement conduit, although service from pull boxes to lighting standards is via buried rigid steel conduit which is thoroughly rust-proofed by grit-blast cleaning, priming coats of coal tar and coal-tar enamel, spiral wrappings of asbestos felt, a recoating of coal-tar enamel, and a final wrap of Krinkle-Kraft paper. This same application also continues slightly above grade as buried conduit sweeps up at the meter loop assembly, after which uncoated galvanized rigid steel conduit continues to the service head.

Included in the meter loop assembly is an activating photocell unit, a raintight flasher and a 3-pole (solid neutral) multi-breaker-type 220-volt switch.

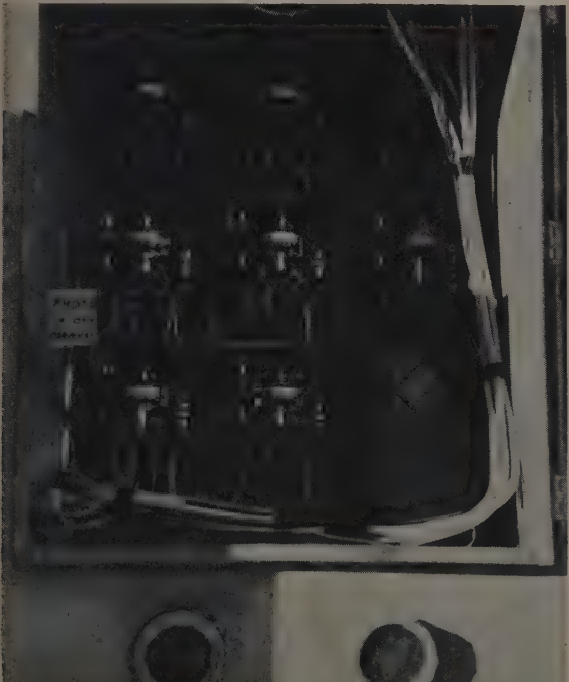
Since large surfaces of high-reflectance natural rock surround the portals and approaches to this tunnel project, thereby increasing outside-inside brightness ratios still further, design engineers deliberately lessened exterior brightness by specifying black asphalt topping for approach roadways. And con-



THIS TUNNEL VIEW shows symmetrical variations of lighting intensities from portals toward center of tunnel dropping progressively from 50 fc to 25 to 16 to 11 fc, then returning to 50. Symmetrical installation from either end was dictated by fact that tunnel carries 2-way traffic. This view, showing lighting arrangement for daylight hours, was taken at night in order to better illustrate the return to portal conditions at the far end of the tunnel. Actually, night-time lighting in tunnel is a fairlv even 6 fc from portal to portal.

versely, they covered roadway surfaces within the tunnel with light-color concrete, then surfaced tunnel walls with two coats of white vinyl paint having an RF of 60%. This treatment has proved completely satisfactory, economical and easy to maintain plus helping to reduce accidents.

This practical solution to a serious lighting problem was designed and installed under the supervision of H. Stead, traffic supervisor, Arizona Highway Department, while the entire electrical installation was handled by Newbery Electric Corporation through their branch office located in Tucson.



MULTIPLE MERCURY RELAYS are equipped with fuses on coil and load sides as well, while coils are additionally protected by lightning arresters. Switching of the 16 lighting circuits is regulated by astronomic clock with carryover characteristics synchronized to exact latitude of tunnel, while control is also instrumented through photocell unit.

SERVICE METER LOOP assembly, related to mercury-vapor approach lighting system, is mounted on creosoted poles anchored in concrete. Assembly includes transformer can, metering equipment, 400-amp 3-pole fused main switch and driven grounding rods. Black asphalt surface of approaches minimizes glare from sunlight.

Magnetic Amplifiers Team Up With Amplidynes

. . . to control rolling-mill dc motor speeds. Completely automated, this new rolling mill employs closed-loop control to synchronize motor speeds rapidly and accurately.

ONE of the latest advances in modern automation is a new copper rod mill at the Hatfield Wire & Cable Div. of Continental Copper & Steel Industries in Linden, N. J. Monitored by a lone operator, the mill automatically transforms copper bars—about the size of railroad ties—into coils of $\frac{5}{16}$-in. diameter rod. This rod later becomes one of the various kinds of insulated electrical wire produced at Hatfield.

Fig. 1 shows the rolling-mill equipment layout and floor plan of the adjacent control room. To regulate speeds of the 100- to 200-hp dc motors, which power the mammoth rolls, engineers selected a magnetic amplifier—amplidyne system. This system has the fast speed of response and high accuracy required by rolling mills of this type. In addition, individual speed regulation for each roll-stand drive motor provides roll-speed synchronization. Roll-speed synchronization and accurate speed control are necessary for several reasons. As a bar is being reduced into a rod, it will be in nine roll-mill stands simultaneously. A change in roll speed may cause the rod to "loop," that is to leave the rod guides, or to cobble (pile up at the roll), delaying production.

Driven by a 4160-volt, 875-hp synchronous motor, a 600-kw generator supplies direct current to a common bus arrangement through steel-mill type line panels. From here, power extends in underground conduit to the 5 dc motors, which drive the rolls.

An underfloor forced-air cooling system, ducted beneath the dc motors and the 550-hp roughing mill ac motor, directs a high-velocity air stream up and around the motors. Special enclosures around each motor create a positive pressure, which prevents copper dust and dirt from entering the enclosure, thus keeping the motor clean.

Auxiliary equipment includes motor-driven rheostats, a power distribution control center, a variety of controls and a magnetic amplifier-amplidyne control panel.

It is interesting to note that although this rolling mill is automated to a very high degree, practically all electrical equipment and controls are standard components, resulting in lower costs. And, because Hatfield engineers wanted the utmost in dependability, they specified only rugged, easy-to-maintain equipment.

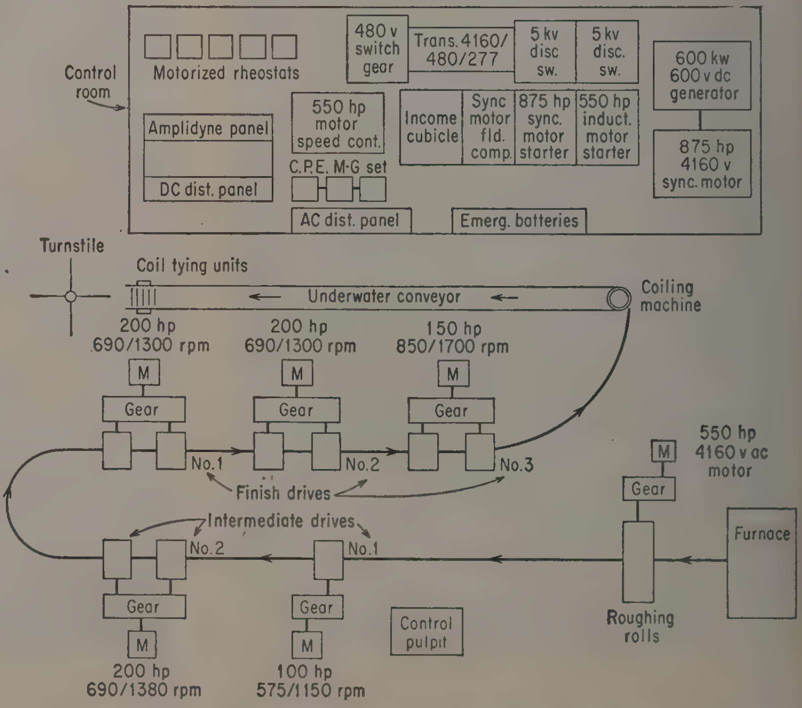


FIG. 1—Sketch shows rolling-mill equipment layout and floor plan of adjacent 2000-sq-ft control room. From the control pulpit, the lone operator can observe movement of the bar (bar travel indicated by arrows) as it is automatically being rolled into rod.

Rolling Process

A lone operator, in an elevated pulpit, controls the rolling process. Here, surrounded by a multitude of tachometers, voltmeters, ammeters, etc., he can observe the copper bars as they leave a 1600°F heating furnace on a powered conveyor. This conveyer brings the bars to the 3-roll-high roughing mill, which is powered by a 550-hp, 4160-volt ac motor. Here the bars automatically make five reversing passes through the rolls. After the fifth pass, the bar (now nearly 60-ft long) continues on through the three intermediate and six finishing rolling mills. Thus the bar is gradually rolled into approximately 900-ft of $\frac{5}{16}$-in. diameter rod. After leaving the last rolling stand, the rod continues through guides to a coiling machine which, after coiling the rod, drops it onto an underwater conveyor. Traveling underwater, the coil of rod is quenched; emerges onto a machine which ties the coil and then loads it onto a turnstile ready to be taken to further processing.

Power Distribution

At Hatfield, this rolling mill is located in a separate building, which also contains other process and storage areas. Power enters the building underground at 4160 volts. Located in a 2000-sq-ft control room adjacent to the roll-mill area, a 750-kva unit substation reduces the primary voltage to 480/277 volts, 3 phase.

In underfloor conduit, 480 volts feeds a distribution center. From here, utilization voltages fan out underfloor to serve distribution transformers, lighting and miscellaneous equipment.

Through a 2000-amp disconnect switch and a motor-starting cubicle, 4160 volts feeds the roughing-mill 550-hp ac induction motor. A 5-kv capacitor, installed across the motor terminals, helps to protect the motor from voltage surges. From an adjacent cubicle, 4160 volts also energizes an 875-hp synchronous motor. This motor is the drive for the dc power supply.

From the power supply generator, rated at 600 kw, 600 volts dc, four 250 MCM cables carry direct current through an underfloor plenum to the main dc distribution line panel. From here, 600 volts radiates in underfloor conduit to the dc motor armatures. Underfloor distribution was selected because of a 10-ton overhead bridge crane, which must reach all parts of the rolling mill.

The dc distribution line panel is a ruggedly built traditional steel-mill type. Protected by a 2000-amp air circuit breaker, $\frac{1}{4}$ by 4 in. open-mounted copper busbars connect 600 volts to dc motor contactors. Remotely operated from the control pulpit, these magnetic contactors have separately mounted overcurrent and overvoltage relays. And knife-blade disconnect switches provide manual disconnecting means for safety purposes.

Control wiring from the adjacent magnetic amplifier-amplidyne control panel extends to the dc distribution board overhead in parallel 4- by 4-in. screened ducts.

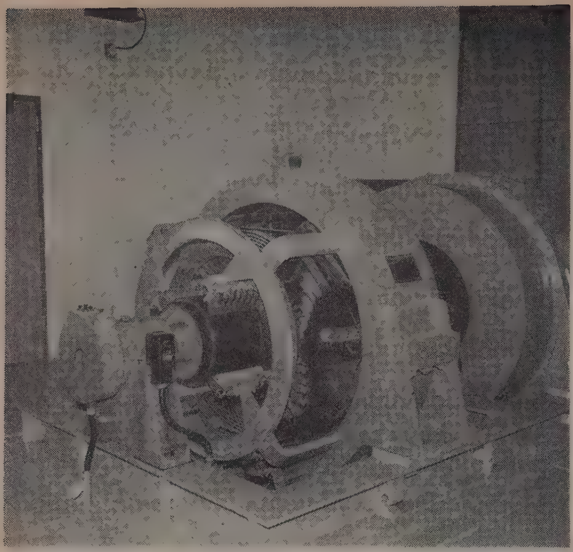
Closed-Loop Speed Control

The speed-regulating system provides "closed-loop" control. In a closed-loop speed-control system, an output signal, representing speed, is compared to a reference (in this case a voltage) representing desired speed. Any deviation of speed —and therefore the output signal —is fed back into the control system to make required corrections.

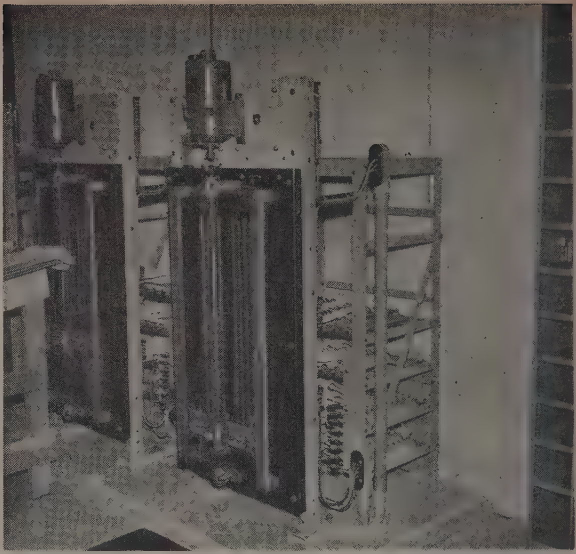
Major components in the speed-regulating system are: (1) dc supply 600-volt generator, which is magnetic amplifier-amplidyne regulated; (2) five roll-mill dc motors, each with individual magnetic amplifier-amplidyne control; (3) a constant potential generator, voltage regulated, which supplies 250-volt dc control power and the speed-regulating system reference voltage; (4) tachometer generators which provide the output (feed

SPECIAL ENCLOSURE protects 550-hp 4160-volt ac rougher motor from copper dust and foreign particles. A high-velocity air stream, ducted beneath the motor, creates a positive pressure within the enclosure thereby keeping metallic dust and dirt out.

AC DISTRIBUTION CENTER supplies 480 volts to various motors and distribution transformers; 277 volts for fluorescent lighting; 120 volts to miscellaneous equipment. In the foreground, the constant potential exciter M-G set provides the 250-volt control power and reference voltages required.



DC GENERATOR, rated at 600 kw 600 volts, supplies the armature voltage to the rolling-mill dc motors. Driven by an 875-hp synchronous motor, the generator is magnetic amplifier-amplidyne regulated. Three temperature-sensing elements trip an alarm if bearings overheat.



MOTORIZED RHEOSTATS, operated from the control pulpit, set voltage levels in the speed-control circuits. When the mill is on manual control, the operator can adjust the rheostats to make speed adjustments for any motor in accordance with tachometer readings.

MAGNETIC AMPLIFIER-AMPLIDYNE control panel has a separate speed-control section for each motor. On the front of the panel are tachometers, voltmeters and ammeters, which facilitate testing or troubleshooting. Magnetic amplifiers and amplidynes are mounted behind the panel.

DC DISTRIBUTION LINE PANELS (on left) feed 600 volts to the five roll-mill motors. The generator line is protected by an open-type 2000-amp circuit breaker. On the right is the magnetic amplifier-amplidyne control panel. Five amplidynes, one for each motor speed control, can be seen on the floor.

back) signal. These tachometers, coupled to rotors of each dc motor, generate a voltage that varies according to respective motor speeds.

Of course, there are varying degrees of accuracy in closed-loop control. And at Hatfield, the speed-regulating system must start to correct any speed deviation, no matter how small, immediately. With the high-quality tachometer generators, extremely small speed variations generate voltages which are detected and amplified by the magnetic amplifiers. These magnetic amplifiers act as preamplifiers to increase the output signal to be applied to the control winding of the amplidyne. In this way, the moment a speed deviation starts to occur, it can be corrected before an extreme speed deviation can become established.

An electronic preamplifier could

LONE OPERATOR monitors rolling mill from an elevated control pulpit. By observing tachometers and ammeters, the operator checks motor speeds and motor current. Although the entire process is automated, he can stop the mill quickly in an emergency, or he may vary motor speeds if necessary.

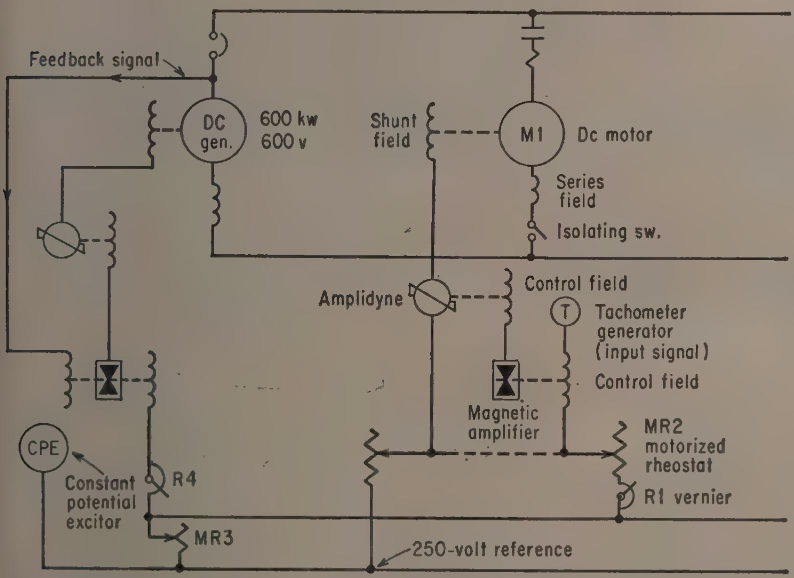


FIG. 2—Diagram shows basic speed-control system arrangement. The tachometer generator's output voltage, which varies according to motor speed, is applied to the magnetic amplifier control field. Preset by R1 and MR2, the reference voltage is also applied to the magnetic amplifier control field and, when the motor speed is correct, the two voltages balance. A minute variation in motor speed causes a voltage unbalance in the magnetic amplifier control field. Amplifying this unbalance voltage, the magnetic amplifier applies the signal to the amplidyne control field. This causes, in the amplidyne's high-power output circuit, either an increase or decrease of current to the shunt field of the motor, whichever is needed to make the proper speed correction.

have been selected in place of magnetic amplifiers. Electronic control would have resulted in more amplification and even higher accuracy. But Hatfield engineers desired the ease of maintenance offered by magnetic amplifiers and amplidynes. Moreover, the magnetic amplifiers-amplidyne combination resulted in speed control that is more than adequate for this kind of rolling mill.

The speed-controlled drive system consists of five dc motors on a common bus with the 600-volt generator. Years of experience plus careful calculations have shown rolling-mill experts what the proper speed of each motor should be. Each motor, through adjustments of their individual speed-control systems, is set for a predetermined speed. And these speeds must be maintained accurately to avert the possibility of fouling a bar.

A minute speed change will cause the tachometer generator's output to change slightly. This small variation is preamplified by the magnetic amplifier. Greatly increased, the signal is fed to the amplidyne causing the amplidyne's output, which is connected in motor field circuit, to make speed corrections.

Because dc motor speeds are a function of armature voltage as well as field flux, the main dc generator is regulated, also by magnetic amplifier-amplidyne control. A motorized rheostat, connected in the generator's control circuit, can set over-all speed of the system. However, each motor has somewhat different characteristics. Because of this, their speeds do not change by the same ratio. To correct speed variations due to this armature voltage control, each motor has an individual speed-control system.

Referring to Fig. 2, an analysis of the speed-control system is as follows:

If the speed of motor M1 is correct, the output of the tachometer generator, which is applied to a control winding of the magnetic amplifier, will exactly balance the reference voltage which is also applied to a control winding. Under this condition, and with rheostats (R1 and MR2) previously set for correct voltage levels, the magnetic amplifier output allows the motor speed to remain unchanged.

If the speed of the motor drops, however, the output of the tachometer generator will drop. This unbalances the input signal voltage with the reference voltage causing current to flow in the output winding of the magnetic amplifier. This amplified output is applied to the control winding of the amplidyne. Direction of this control current flow is such that it causes the power current from the amplidyne to the motor shunt field to become smaller. Thus, the motor field is weakened resulting in an increase in motor speed.

The electrical installation was made by Molnar Electrical Contractors, Inc. of Woodbridge, N. J.

Humidity and Condensation—V

Installation of vapor barriers in the electrically heated house.

By W. J. Novak

SELECTING and specifying an excellent vapor barrier to avoid future moisture damage is only a partial solution of the problem. To be completely effective, the barriers must be installed correctly and in the proper place. The heating installer should make certain that the principles discussed below are observed.

Where should the vapor barrier be installed? Actually, the criteria for vapor barrier location is that it be placed in such a position that its temperature will never be lower than the dew point of the ambient vapor. If it were, vapor would condense on its surface and defeat its purpose. For most construction, this means that the barrier is placed between the insulation and the interior wall, ceiling, or finished floor.

For most applications, it is generally recommended that the vapor barrier be placed as close as possible to the warm side of the wall, floor, or ceiling. This tends to raise the vapor resistance of the wall between the inside air and the sheathing; the resultant pressure tending to move moisture into the wall becomes less than the pressure tending to move moisture out of the wall to the outdoors. Also, through its high vapor resistance, the vapor barrier permits a much smaller amount of moisture to get into the wall in the first place.

The series on humidity and condensation continues this month with a discussion of proper methods of installing vapor barriers. The final article will cover humidity control through ventilation.

Readers are invited to express opinions or submit their own experience data on any aspect of electric heating. Please address correspondence to:

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Electrical Construction and Maintenance
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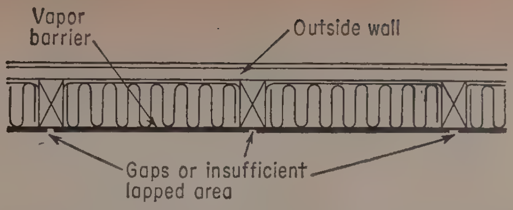
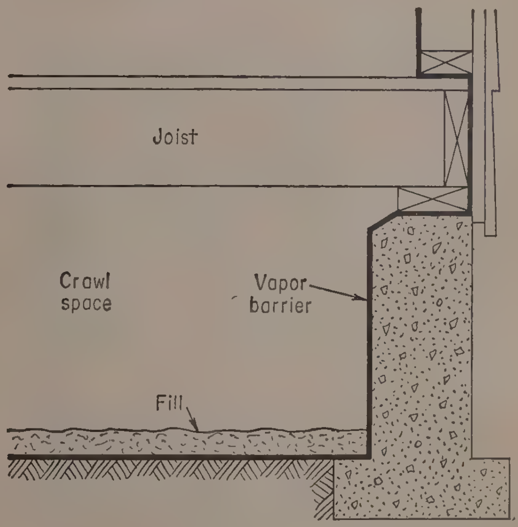
The question arises as to its effectiveness in keeping moisture from condensing in the walls during the summer, when conditions are reversed and vapor pressure is greater outside the house. Because of the smaller indoor-to-outdoor temperature difference, temperatures within the wall are not likely to reach the dew point. However, there is a possibility, in areas having very warm summers, that condensation could occur within a fully insulated wall on the sunny side of a house (or in a ceiling) for one or two hours a day if inside temperatures are kept at 70F or lower by air conditioning. Such conditions are difficult to predict in advance; and if they do occur, their correction requires very specialized design involving strategic location of the vapor barrier or ventilation of the wall or ceiling cavity.

How are vapor barriers installed? As discussed previously, insulating batts and blankets may be obtained with a vapor-resistant material covering one face. These barriers are furnished with protruding flanges along each edge which may be stapled to the inside edges of the wall studs (or ceiling joists). By overlapping the flanges on successive studs, the result is a continuous vapor barrier over the entire wall surface. An alternate fastening method, used to some extent with 1- to 2-in. batts, has been to staple the barrier flanges to the faces of the two bordering studs, thus recessing the batt and forming an additional air space between the insulation and the plaster or gypsum board. However, this method leaves much to be desired from the standpoint of moisture control, since wood is relatively permeable to moisture; and the framing, comprising 10% or more of the wall surface, is thus unprotected by a barrier. Edge-stapling is more common in electrically heated houses, chiefly due to the extensive use of batts of full-stud thickness.

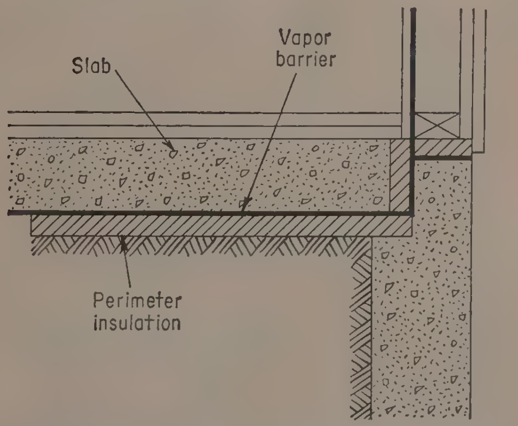
Where wall studs are on 16-in. centers and insulating batts at least 3-in. thick are used, considerable time can be saved by installing the batts between the studs without stapling. The usual 15-in. width



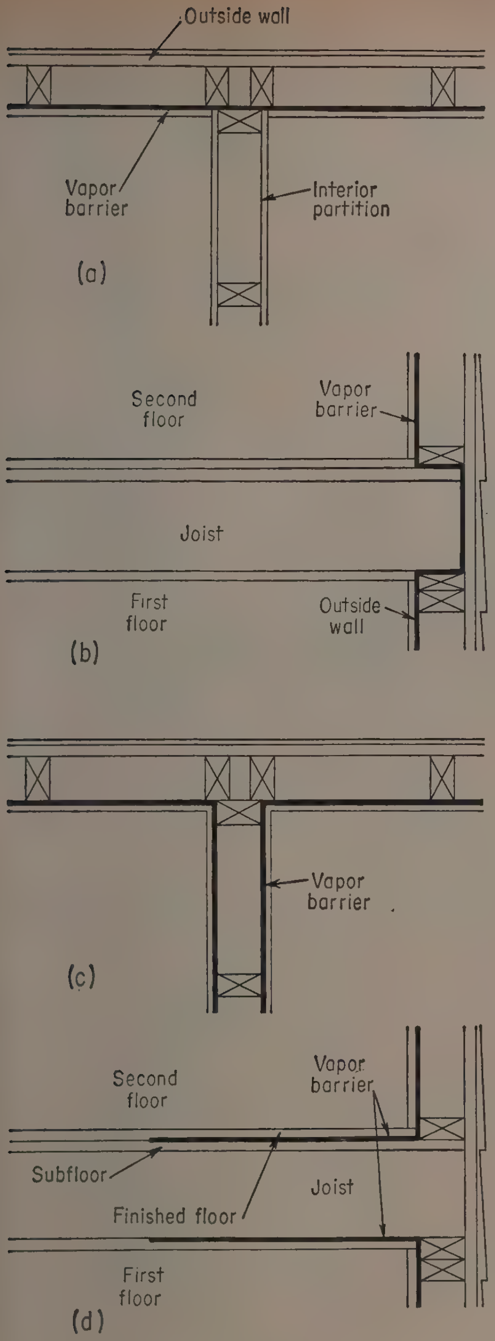
FLANGES of vapor barrier furnished as part of insulating batts should substantially overlap edge of stud or joist at stapling point, since wood is very permeable to water vapor.



CRAWL-SPACE barrier protection should extend up sidewalls and around floor joists to protect against moisture from earth as well as living space.



SLAB-ON-GRADE construction should include vapor barrier over ground and over foundation to shield structure from capillary action of ground moisture.



INTERSECTIONS of interior walls and multi-story ceilings with outside walls are often neglected in vaporproofing and can be a source of moisture trouble. Sketches (a) and (b) show most effective way to protect these points but require that sections of vapor barrier be handled during early phases of construction. Sketches (c) and (d) show an alternative method. Barrier can be installed after framing members are in place but before finished walls, floors and ceilings are put in place. In (c), barrier should extend 1 or 2 stud spaces along partition; in (d), 2 or 3 ft under floor and over ceiling. Lengths of any suitable vapor barrier can be cut for the purposes where barrier-faced insulating batts are used and can be left loose or tacked in place lightly until insulating job has been completed.

provides a snug fit, and the 3-in. thickness precludes settling or buckling. Vapor protection can then be provided by continuous polyethylene film across the entire inner wall surface. Stapling is required only at the extreme edges of the film and at windows or other openings, since the application of the finished wall will fasten it securely. For such an application, the batts need not have integral vapor barriers, nor even a paper enclosure; however, the enclosure will provide protection from physical damage during construction.

A ceiling vapor barrier is often omitted when blown insulation is used in the attic; however, this is poor practice. Full dependence is placed in such cases upon the effectiveness of the attic ventilating openings to dispel accumulated water vapor. While ventilation is important and necessary, it may be inadequate to properly vent excessive water vapor, particularly during periods of low average wind speeds. Omission of the ceiling vapor barrier is false economy, since any condensation anywhere in the attic space will drip down onto the insulation, impair its effectiveness, and increase heat loss—in addition to inevitable deterioration of the wooden framing or, in extreme cases, staining of ceiling plaster or gypsum board.

The most effective solution to this problem is to stretch a sheet of polyethelene film, 2 to 4 mils thick, across the entire ceiling, stapled to the underside of the ceiling joists, before the finished ceiling is applied. The insulation is poured or blown on top of the plastic between the joists after the ceiling is in place.

Floors above crawl spaces or unheated basements present another installation problem. Stapling the vapor barrier flanges of the batts to the tops of the floor joists before laying the subfloor is a difficult job, and the barrier as well as the insulation is likely to suffer considerable damage before construction is completed. On the other hand, if the flanges are stapled to the bottom edge of the joists from below, the vapor barrier will be facing the cold side rather than the warm side. Insulation manufacturers have simplified the problem recently by introducing batts with the flanges on the breather face of the insulation, so that they may be stapled from below and yet leave the vapor barrier on the face of the batt closest to the floor surface.

Where the conventional insulating batt is used, it is usually necessary to place the batt between the joists from below and then provide some means of support beneath the insulation (such as chicken wire, furring strips, or special supports manufactured specifically for the purpose) to hold it in place. This makes it possible to place the vapor barrier of the batt facing the floor. Again, large sheets of unbroken plastic film spread over the top of the subfloor provide a quick, simple and efficient means of vapor control, covering the joists as well as the insulation.

Considering the previous discussion on ground moisture, the question might arise as to whether it is more important in the case of a crawl space to protect the floor from moisture from below or moisture from the house interior. The answer is that both must be minimized—the interior moisture by one of the methods discussed above, and the ground moisture by a suitable barrier on the ground. If a concrete floor is provided in the crawl space, the barrier should be laid before the concrete is poured to prevent moisture migration. If the floor is bare earth, the barrier should be spread to cover the earth. If rolled material is used, adjacent strips should overlap at least 4 in. If large plastic sheets are used, they should be overlapped where necessary.

We have here a situation where the structural members to be protected from moisture are bounded top and bottom by vapor barriers; therefore, some ventilation or dehumidification is necessary to dispel any vapor that does pass through the barriers into the crawl space. Minimum requirements for such ventilation will be discussed subsequently.

Throughout the installation of vapor barriers, particular care must be taken to seal any necessary openings in the barriers, such as at outlet boxes, ventilating fans, and around water pipes and electrical conduit. (Water pipes should preferably be between the vapor barrier and the insulation.) In addition to providing protection against moisture, the vapor barrier efficiently reduces infiltration of cold air into the structure. Careless tearing of the barrier and insulation around such wall and ceiling penetrations will not only permit water vapor to escape; it will aggravate heat loss. The accompanying sketches suggest additional considerations which deserve attention to provide a top-notch job.

New UL Standard for Electric Heating Equipment

An important new 81-page standard for heating equipment fabrication, *Standards for Safety: Electric Space-Heating Equipment* (UL 573, First Edition), has been prepared by Underwriters' Laboratories, Inc.

It includes detailed requirements which must be met by all equipment submitted for test to UL. Until April 1, 1962, UL will review all space heaters now listed to determine compliance with the new standard, notifying manufacturers of any change which must be effected to comply. During this time, manufacturers are also expected to review their own equipment and make necessary changes. After April 1, 1962, listing of equipment incorporating any features not in compliance with the standard will be discontinued.

Minimum standards are given for materials and components used in all commonly used wall, baseboard, and ceiling heaters, plus cord-connected units, duct heaters, and central furnaces.

This standard, adopted after long and careful study, discussion, and review by the Laboratories' staff, is a major step in the effort to insure that the outstanding performance and advantages possible with electric heat will be realized through the use of quality equipment.

Second NEMA Electric Heat Conference Scheduled

Final plans have been announced by the Electric Comfort Heating Equipment Section of the National Electrical Manufacturers Association for its second National Electric Comfort Heating Exposition and Symposium on March 19-21, 1962, at the Sherman Hotel in Chicago, Ill.

Theme of the exposition will be "Sell Electric Comfort Heating Cooperatively." Discussions at the planned seminars will feature calculations for various types of electric heat, methods and selection of equipment, new advances, and sales techniques. Chairman of the exposition will be Keith M. Spurrier, Central Area Sales Manager, Robbins & Myers, Inc. The morning of March 19 has been set aside for registration purposes.

Heating Contractors, Plumbers, and Electric Heat

U. S. Dept. of Commerce survey shows installations made during 1959.

QUESTIONNAIRES sent out by the Building Materials Div., Business and Defense Services Administration, U. S. Dept. of Commerce, to heating contractors, larger plumbing contractors, and fuel oil distributors in the United States provide what is perhaps the first available data on the extent of participation of these groups in the installation of electric heating equipment.

The survey covered only a selected portion of the 44,075 installers whose identities were available from government records, therefore extensions of the data to form conclusions of nationwide activity should not be made. Note that electrical contractors were not included; therefore the results are in no way an indication of total electric heat activity.

Of the 9,456 reports received, 6,805 reported installation of 392,680 heating units, including 3,003 (0.77%) electric heating systems.

The accompanying tables show a percentage breakdown of the electric heating systems reported, arranged according to geographical area, type of occupancy, and whether new or replacement, plus a summary of total units installed.

Installation of Electric Heating Equipment by Heating Contractors and Plumbers, 1959

District	New Construction (%)				Replacement and/or Modernization (%)			
	Single Family	Multi-Family	Com'l. & Indust.	Sub-Total	Single Family	Multi-Family	Com'l. & Indust.	Sub-Total
1	9	—	91	100	—	—	—	—
2	32	—	8	40	29	24	7	60
3	64	1	4	69	30	*	1	31
4	49	—	2	51	48	—	1	49
5	60	2	20	82	13	2	3	18
6	70	—	3	73	25	—	2	27
7	59	—	33	92	5	—	3	8
8	43	—	17	60	19	—	21	40
9	12	9	15	36	61	*	3	64
Entire U. S.	48	3	12	63	33	1	3	37

District	Total Units Installed	
	Number (Approx.)	%
1	12	0.4
2	72	2.4
3	475	15.8
4	285	9.5
5	628	20.9
6	544	18.1
7	195	6.5
8	72	2.4
9	720	24.0
Entire U. S.	3003	100.0

* Less than 1%

District Breakdown

1. New England
Maine Vt
Mass NH
Conn RI

2. Middle Atlantic
NY
NJ
Pa

3. East North Central
Wis Ill
Mich Ind
Ohio

4. West North Central
Iowa ND
Kans SD
Minn Mo
Nebr

5. South Atlantic
W Va Md
Dela SC
Fla NC
Va Ga

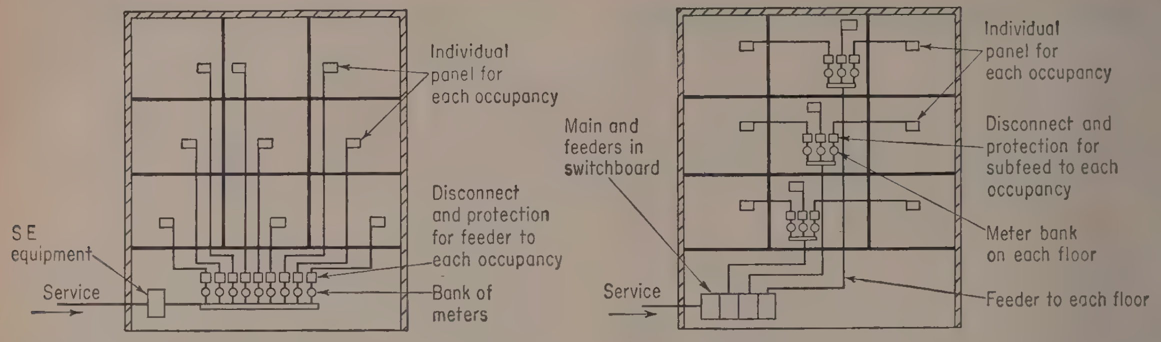
6. East South Central
Tenn Ala
Miss Ky

7. West South Central
Okla Tex
Ark La

8. Mountain
Mont Wyo
Idaho Nev
Utah Colo
Ariz NM

9. Pacific
Wash Hawaii
Calif Ore
Alaska

FIG. 1—Basic Schemes for Individual Unit Metering in Multiple-Occupancy Buildings Are Limited by Requirements of Conventional Metering Techniques


Individual panel for each occupancy
Main and feeders in switchboard
Disconnect and protection for feeder to each occupancy
SE equipment
Service
Bank of meters
Individual panel for each occupancy
Disconnect and protection for subfeed to each occupancy
Meter bank on each floor
Service
Feeder to each floor

Case I
Individual feeder to each occupancy from basement meter bank. This system provides least diversity in distribution system, requiring relatively large amount of total conductor capacity. System demand is essentially the total of the individual demands of the feeders. Total rating of phase conductors is highest for any possible distribution system and full-size neutrals are generally required.

Case II
A common feeder to each floor affords use of lower demand factor in sizing conductors for total load of three unit occupancies. This layout and any variations on it, which permit use of a common feeder to a group of units, can effect substantial wiring economies in material and labor over the layout shown in Case I. However, the need for metering of the individual occupancies can appreciably curtail economies which could be made if conventional meter bank arrangements could be eliminated.

Substantial wiring economies with . . .

Remote Metering System

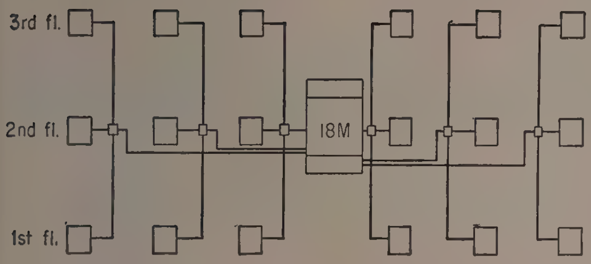
. . . for individual unit metering in multi-occupancy buildings.

For new construction and for modernization, this novel system provides for individual unit metering in multiple-occupancy buildings that have distribution systems designed for all of the diversity advantages of common feeders to groups of unit occupancies.

By J. F. McPartland

A NEW system of remote energy metering can provide individual metering of each occupancy in a multi-occupancy building without the sacrifices in distribution economy normally required for unit metering. Fig. 1.

The key to this new remote metering method is a special type of current transformer applied at each point in the system where the energy is to be metered—such as at each subfeed to an individual occupancy. Fig. 2. This CT is designed to provide automatic ratio and phase-angle correction to compensate for the effect of inaccuracy



Case III
This is a common variation on Case II. One meter bank is used to supply three floors. The relatively long horizontal runs—commonly 3 No. 6 in 1-in. conduit or 3 No. 4 in 1¼-in. conduit—may cause serious problems in buildings having steel construction with only 4-in. slabs.

This story discusses the many factors involved in metering of electrical energy utilization in multi-story, multiple-occupancy buildings. The method of remote individual unit metering with a self-compensating current transformer is the patented invention of Herman Wald, M. S., consulting electrical engineer, Astoria, N.Y. (He is chief electrical designer for Bardos & Ettinger, Consulting Engineers, N. Y. C.)

The over-all subject is vitally important in view of the accelerated building of apartment houses and office buildings with the widely varying attitudes of building managements on the subject of rent-included electric supply for tenants vs tenant purchase of energy. The method of metering selected for any such building may be a significant factor in cost of the building. The particular electrical load requirements of tenants may dictate either master metering or unit metering, or may indicate the desirability of master metering for some tenants with unit metering for other tenants. And local conditions as to availability of rental space and the competition among owners in renting out their space are often involved in the choice between master or unit metering. The remote metering system described here makes possible flexible and interchangeable use of both master and unit metering. We present this story to bring the problem into focus and to describe a solution which merits the attention of engineers, contractors and manufacturers.—Editor

introduced by the highly increased secondary burden of the unusually extended secondary leads. This self-compensation feature makes possible accurate measurements regardless of the varying lengths of secondary leads from CTs to meters.

To effectively comply with the plan, the special CT is a relatively small device—approx. 4 in. by 6 in. by 2 in.—and is designed to be installed in the panelboard for each apartment or office tenancy. The low-voltage secondary wiring from the CT to its associated meter is approximately No. 20, since it carries a maximum of 1 amp when a CT with a ratio of 50:1 is applied to an apartment demand load of 50 amps per phase. All secondary wiring for all of the unit occupancies along a typical riser run up to 20 apartments of a 20-story building might be installed in, say, one 1-in. conduit. The meter to be used may, of course, be similarly selected for maximum of 1 amp or up to 2½ amps.

In operation, the losses through the long secondary leads are automatically compensated in the novel CT, which measures the load current with a predetermined constant ratio and without ratio or phase error. In order to simplify installation, the potential coils of all of the watt hour meters are directly connected to the most convenient line terminals at the meter location. The remote metering system also incorporates protection which automatically interrupts the current supply through any CT in case of short circuit or an open in the secondary wiring to the meter. Thereby, use of energy is prevented when meter operation is interrupted.

Traditionally, individual metering in multiple-occupancy buildings—particularly high, multi-story buildings—has had one serious disadvantage. The distribution system, designed to accommodate all of the unit meters, was a more expensive and less efficient system than might be designed for the same load if unit metering were not required, that is, if master metering were

FIG. 2—Elements of Remote Metering Scheme

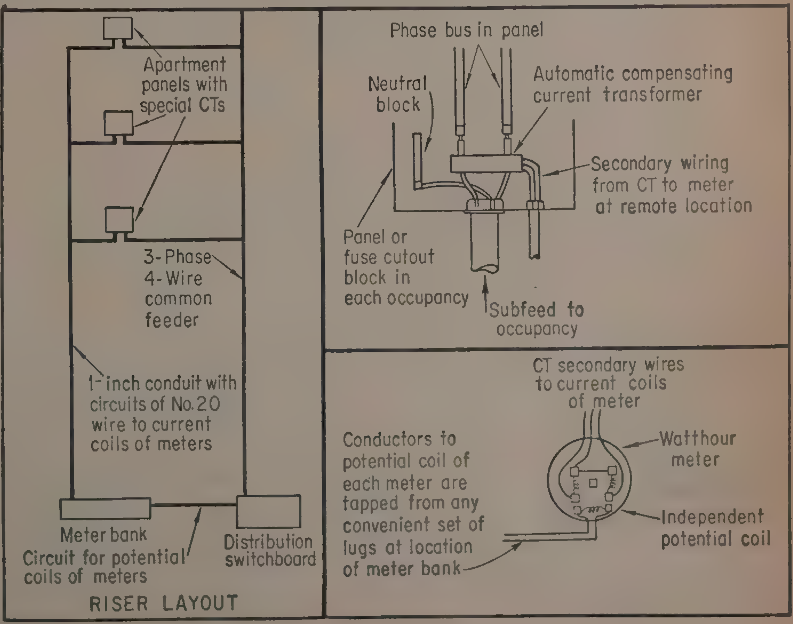
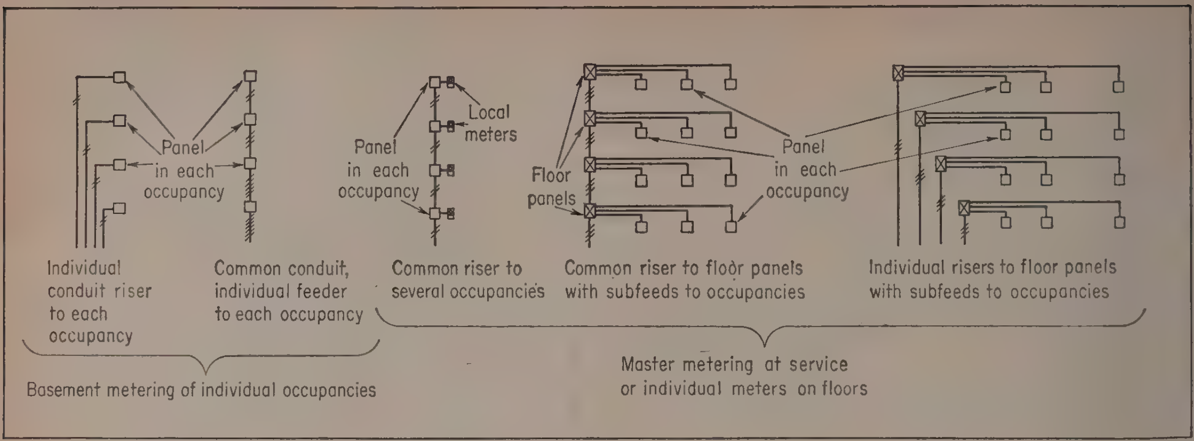

Apartment panels with special CTs
3-Phase 4-Wire common feeder
1-inch conduit with circuits of No. 20 wire to current coils of meters
Meter bank
Circuit for potential coils of meters
Distribution switchboard
RISER LAYOUT
Phase bus in panel
Neutral block
Automatic compensating current transformer
Secondary wiring from CT to meter at remote location
Panel or fuse cutout block in each occupancy
Subfeed to occupancy
CT secondary wires to current coils of meter
Watthour meter
Conductors to potential coil of each meter are tapped from any convenient set of lugs at location of meter bank
Independent potential coil

FIG. 3—Riser Layouts for Multiple-Occupancy Buildings with Conventional Metering


Panel in each occupancy
Individual conduit riser to each occupancy
Common conduit, individual feeder to each occupancy
Basement metering of individual occupancies
Local meters
Panel in each occupancy
Common riser to several occupancies
Floor panels
Common riser to floor panels with subfeeds to occupancies
Panel in each occupancy
Individual risers to floor panels with subfeeds to occupancies
Master metering at service or individual meters on floors

used at the service entrance for the entire building. Fig. 3. Where the meter bank or banks are located in the basement, a separate feeder must be used for each occupancy, run from the meter for the occupancy to the branch circuit panel in the occupancy. The system of many long feeder runs is costly in labor and materials compared with a common feeder system where diversity of utilization in a number of occupancies fed from one common feeder permits a lower demand capacity than the sum of the demand capacities of feeders where each occupancy has its own feeder. Fig. 4.

Another economic consideration in unit metering vs master metering is voltage drop. The problem of voltage drop is greater when individual feeders are used instead of a common feeder. This arises from the relation between current ratings of conductors and the resistances of conductors. For instance, taking NE Code figures, a No. 1/0 RHW conductor, rated at 150 amps, has five times the carrying capacity of a No. 10 RHW, rated at 30 amps, based on allowable temperature rise in the insulation. But, as a result of rating conductors for current on their temperature rise, the circumference of the conductor material indicates the relative amount of heat-radiating surface for each size of conductor.

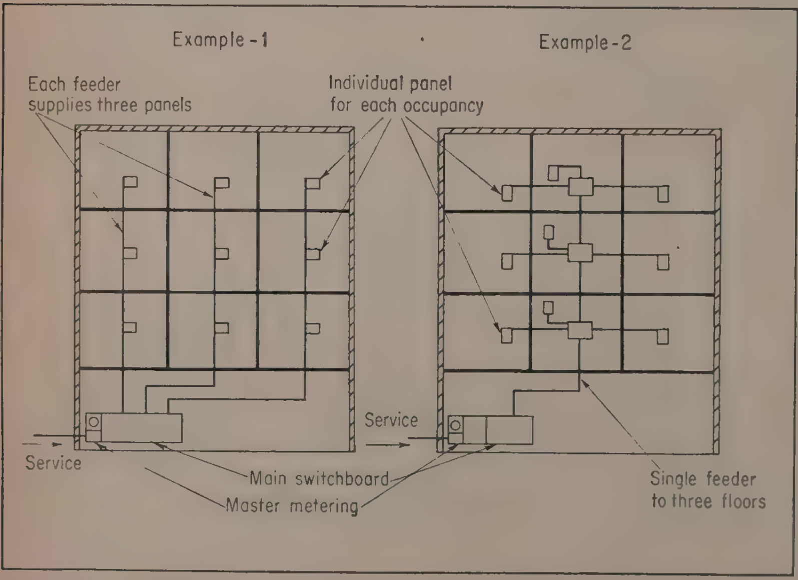
Current ratings increase in proportion to increase in circumference, but the ratio of circumference to cross section area of conductors decreases with increase in conductor size. Larger conductors carry less amperes per unit of cross section. As a result, the larger conductors have lower resistance per ampere than smaller conductors, with consequent lower voltage drop for a given length of the larger conductor under full rated current than for the same length of a smaller conductor under its full load. Our No. 1/0 RHW conductor above has a resistance of 0.106 ohms per 1000 ft, whereas the resistance of the No. 10 RHW is 1.06 ohms per 1000 ft, or ten times that of the No. 1/0.

Considering the above characteristics, a 1000-ft run of No. 10 under full load will have a voltage drop of 30 amps X 1.06 or 31.8 volts. A 1000-ft run of No. 1/0 under full load will have a voltage drop of 150 amps X 0.106 or 15.9 volts. Any voltage drop disadvantage of a small conductor, here the No. 10, must be eliminated by increasing the size. Thus the common feeder distribution system has a big advantage from the standpoint of voltage drop.

Still another consideration is the requirement for neutral capacity in a common feeder compared with that in individual feeders. The need for full-capacity neutrals in the latter case may add substantially to the total amount of installed copper (or aluminum). In particular, where feeders or subfeeders to the individual occupancies consist of two phases and a neutral from a 3-phase, 4-wire wye system, the neutral must be fully-rated for the phase load even under balanced con-

(Continued on page 128)

FIG. 4—Master Metering Permits Any Layout of Distribution for Most Economical System


Example - 1
Example - 2
Each feeder supplies three panels
Individual panel for each occupancy
Service
Service
Main switchboard
Master metering
Single feeder to three floors

• ESTIMATING FORUM—XIV

Fixed-Price versus Cost-Plus Contracts

By **Ray Ashley**, *Research and Consulting Engineer, Oak Park, Ill.*

QUESTION: **With similar costs and the same markups, which is the better —a Fixed-Price or a Cost-Plus industrial contract?**

ANSWER: **The Fixed-Price contract.**

DISCUSSION:

We are comparing the two types of contracts without considering the extra costs and difficulties often experienced in securing competitive work. To prove our point, let's study experiences common to most contractors: first with relation to Fixed-Price contracts; then those associated with Cost-Plus contracts.

Fixed-Price Contracts

In order to get fixed prices on a project, the owner must have complete plans and specifications. To figure the work, the electrical contractor must be thoroughly familiar with the job requirements and have a complete listing of materials and labor necessary.

When the contract is let, the stage is already set for the contractor to proceed in the most expeditious manner. He can formulate a definite program because he knows the approximate duration of the contract, the manpower requirements, the materials needed and how their delivery should be timed, and all other job requirements. Field engineering and construction drawings can proceed with dispatch. These and other fixed-price-contract advantages are familiar to most contractors.

Operating costs for Cost-Plus contracts usually run much higher than those for Fixed-Price contracts. Three principal reasons for this are:

1. Greater cost of expediting.
2. Extended duration (beyond normal).
3. Extra cost of billing.

Cost of Expediting—Plans and specifications are often sketchy and far from being complete. The contractor's engineer is obliged to make many trips to the owner's office to ferret or pump out details.

Because of lack of information and the uncertainty of the construction program, the contractor cannot use his mechanics to best advantage. Neither can he buy materials with the minimum amount of attention. Extra attention is required all through the

(Continued on page 220)

FIGURE 1—ITEMS OF EXTENDED DURATION COSTS FOR AN $80,000 CONTRACT

BASE COSTS Material $36,000
Labor $24,000

NORMAL DURATION
5 MONTHS

ITEMS OF EXPENSE	Normal Costs			Extended Duration Cost	
	The Job			% of Normal	Dollars per Mo.
	% of Labor	Dollars Total	Dollars Per Mo.		
Engineering & Plans (field engineering included)...........	2.5	600.	120.	20	24.00
Field Office and Shop Expense (including Power and Light)....	1.0	240.	48.	20	9.60
Job Telephone................	2.0	480.	96.	40	38.40
Tools........................	3.0	720.	144.	20	28.80
General Insurance and Miscellaneous Job Costs..........	3.0	720.	144.	20	28.80
Travel Between Office and Job..	0.1	24.	5.	60	3.00
Overhead.................	20.0	4800.	960.	40	384.00
TOTAL................					**516.60**

Relight School Stadium With Quartzline Lamps

Lighting an athletic field with Quartzline lamps provided an evenly distributed 20 footcandles.

AN ENTIRELY new concept of outdoor sports area lighting was employed when the athletic field lighting at Brush High School, Cleveland, Ohio, was revamped to improve visibility for both players and spectators. Without increasing total system wattage, Quartzline lamps more than double the intensity of the original system.

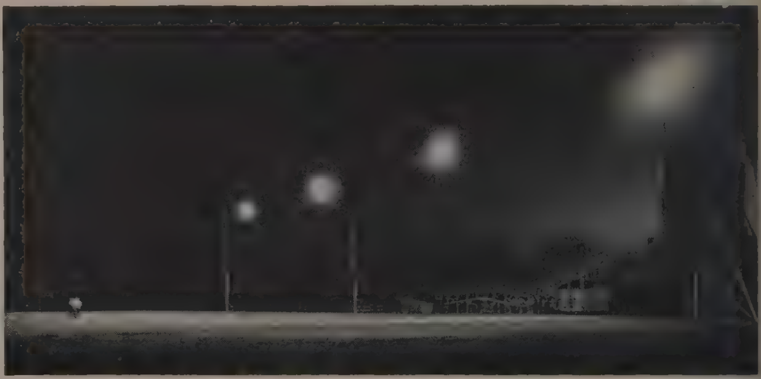
The first of its kind in the nation, the new system was designed and installed by lighting engineers from General Electric's Nela Park. It will be used as a model for the study of new quartz lamp application techniques for sports lighting. The old floodlighting system, installed in 1946, consisted of 64 1,500-watt incandescent lamps in reflectors grouped on eight poles, four on each side of the field. Illumination level at the field was eight footcandles.

The new system consists of 64 1,500-watt Quartzline lamps grouped on four poles, two on either side of the football field. Lighting intensity at the field is now an evenly distributed 20 footcandles, a level recommended by the Illuminating Engineering Society for Class IV stadia which seat 5,000 spectators.

In addition to securing double the footcandle intensity from the same wattage and number of lamps originally used, the school was able to eliminate four floodlight poles. This was accomplished by designing fixtures that project a light beam which has a narrow vertical and a wide horizontal pattern. By controlling light more accurately than equipment previously used, the new fixtures increase illumination by concentrating a higher percentage of light onto the playing field.

The new Quartzline lighting system offers the school added operating economy. The lamps come in weather-resistant quartz tubes, ⅜-in. in diameter and 10 in. long, rather than in glass bulbs. They last twice as long without sacrificing the amount of light produced, and they maintain their original light output and efficiency throughout their lifetime. Constancy of light output is attributed to a revolutionary "iodine cycle" in which, as the tungsten filament evaporates, iodine vapor continuously carries back to the filament the tungsten particles which otherwise would blacken the wall of the tube.

NEW LIGHTING with Quartzline lamps doubles footcandle level on playing field without increasing total system wattage. New lamp fixtures are grouped on four poles instead of the eight needed for the original floodlighting system.



OLD LIGHTING at Brush High School stadium provided only eight footcandles of illumination on the field. The 64 1,500-watt floodlights were grouped on eight poles, four on each side of the field.

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Plus SMALLER SIZE

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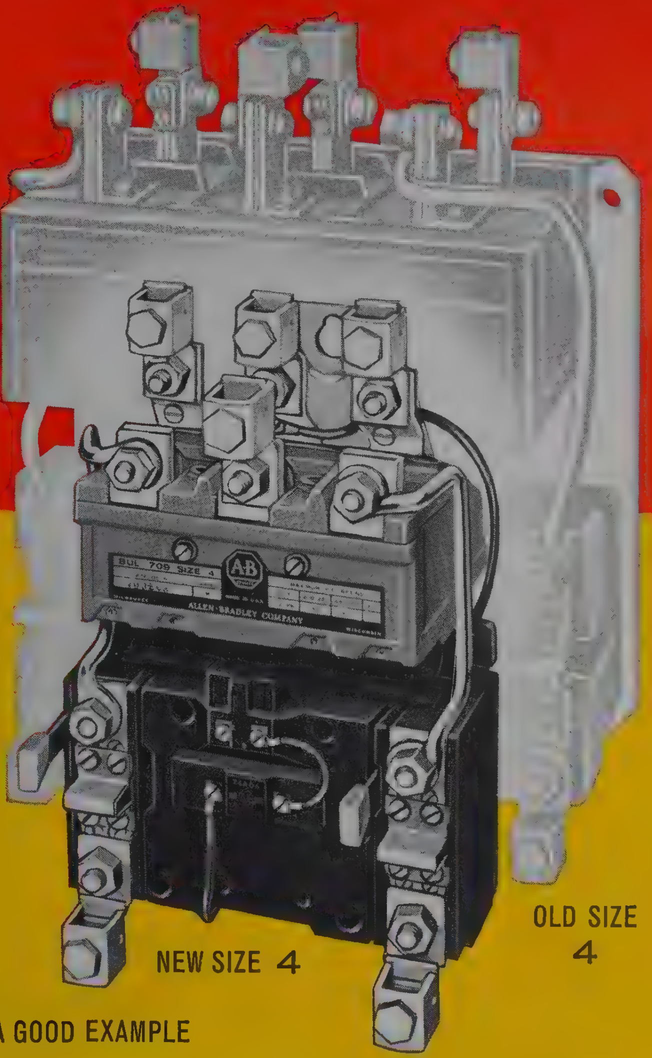

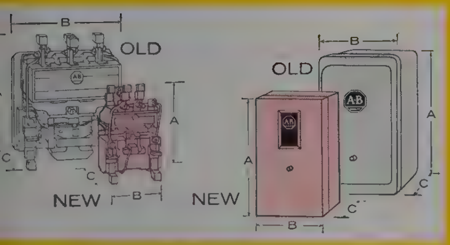

A GOOD EXAMPLE

The new revolutionary Bulletin 709 motor starters are surprisingly small in size—yet, they are good for many more millions of operations—without trouble or maintenance! Rating for rating, they have no equal. They are today's best starter value—and they cost no more!

The "Quality" you've come to expect in all Allen-Bradley control is represented in all details—especially in the "eye appealing" enclosures styled by the world famous industrial designer, Brooks Stevens. Write today for details of the new Bulletin 709 line—the greatest advance in motor control in 30 years: *Allen-Bradley Co., 1316 South Second Street, Milwaukee 4, Wisconsin.*

61-RM

Check These New SPACE-SAVING Dimensions

Starter Size	OPEN TYPE STARTERS						NEMA 1 ENCLOSURES					
	Height A		Width B		Depth C		Height A		Width B		Depth C	
	NEW	OLD	NEW	OLD	NEW	OLD	NEW	OLD	NEW	OLD	NEW	OLD
00	4⅛	—	3⅞	—	3¹¹⁄₁₆	—	7¹¹⁄₁₆	—	4⅞	—	4½	—
0	5⅞	5⅝	4⅛	4¾	3¹¹⁄₁₆	3¼	9³⁄₁₆	7⅞	6⁵⁄₁₆	5⅝	4⅝	4¼
1	6⅝	5⅞	4⅝	5	3¹¹⁄₁₆	3¼	10	8¹³⁄₁₆	6¹³⁄₁₆	6⅜	4⅝	4¼
2	7⅝	10¹⁄₁₆	4⅝	5¾	3¹¹⁄₁₆	4⁷⁄₃₂	12	14½	7⅝	9	4⅝	5⁷⁄₁₆
3	10¼	12⅝	6¼	7¼	5⁷⁄₃₂	5⁷⁄₁₆	16⅝	19½	10⅜	11⅜	7¼	6¹¹⁄₁₆
4	11⅝	16¼	7⅜	12¾	6⅞	6¹⁵⁄₁₆	22	26⁹⁄₁₆	11⅝	14³⁄₁₆	8¼	7¹¹⁄₁₆
5	15⅜	20	9½	16⅛	8⅝	8¾	32⅞	41½	17³⁄₁₆	19⁹⁄₁₆	10⅛	13⁹⁄₁₆

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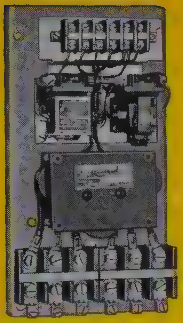
QUALITY MOTOR CONTROL

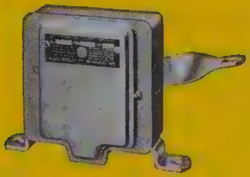
Your A-B Handy Catalog Lists These Control Devices Often Considered "Special"

A-B QUALITY



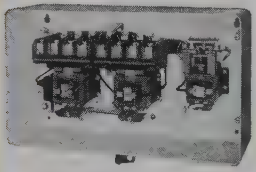
BULLETIN 812
Phase Failure—Phase Reversal Relays

Style F relay (above) protects against all open phase conditions on a branch motor circuit. Style R disconnects the motor upon a phase reversal. Style RF gives phase failure and phase reversal protection.



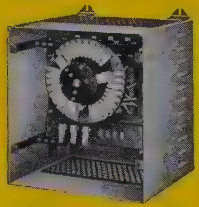
BULLETIN 840
Float Switches

These quality switches are available in a wide range of types for automatic control of motors operating tank or sump pumps. The snap-action switch mechanism assures positive operation, no matter how slowly the liquid level changes.



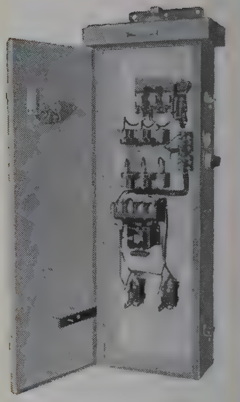
BULLETIN 1270
Automatic Transfer Switches

These switches are designed to transfer power-load to standby supply when normal power fails or drops too low. Automatically returns load to normal supply when power is resumed. Mechanically interlocked.



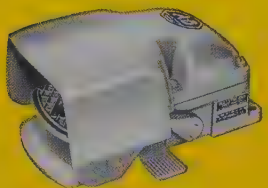
BULLETIN 555
Speed Regulators

Provide manual speed control of wound rotor motors for either fan or machine duty. When used with magnetic starter, the first step closes control circuit.



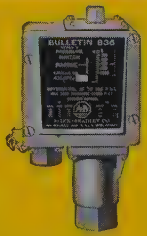
BULLETIN 1232
Pump Control Panels

Complete units for automatic operation of irrigation and oil well pumps. Employ standard A-B Bulletin 709 magnetic starter with manual disconnect switch or circuit breaker in weatherproof enclosure. Wide variety of optional features available.



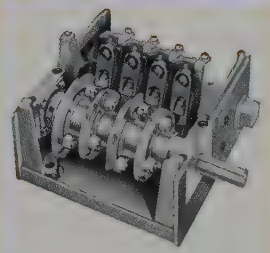
BULLETIN 805
Foot Switches

Ruggedly built to withstand the most severe industrial usage. Snap-action switch mechanism features maintenance free silver contacts. The foot switch shown above assures complete "safety" for the operator. Also made without top guard.



BULLETIN 836
Pressure Controls

For machine tool hydraulic systems operating at pressures up to 5000 psi. Oiltight enclosure. Operating pressure and differential are adjustable. A visible indicator shows trip point. Maintenance free silver contacts.



BULLETIN 803
Rotating Cam Limit Switches

Heavy-duty controls for use on automatic production machines. Made with up to 12 independent circuits which can be separately adjusted for operation at any point of rotation.

BULLETIN 365
Multi-Speed Drum Switches

Designed for manual starting, speed changing, and reversing of polyphase multi-speed motors. Made for up to four speeds either non-reversing or reversing.

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QUALITY MOTOR CONTROL

14-61-RM

Frequency Indicator

Line frequencies of 60 cycles and 400 cycles can be determined with two handy "homemade" indicators. One will indicate a frequency of 60 cycles or less, while the other will indicate a frequency of 400 cycles or higher.

These units are for use on 115-volt circuits. Fig. 1 shows the circuitry for the 60-cycle indicator. And Fig. 2 shows the circuitry for the 400-cycle indicator.

Components are inexpensive and readily available. Parts required for each unit are: (1) a NE-51 neon lamp; (2) a ½-watt carbon resistor (68k or 100k); (3) a 200-volt 0.01 mfd ceramic capacitor; (4) a pair of test leads; (5) a long-handled rubber plug; (6) a pigtail receptacle.

To build your own indicator, follow the instructions below.

1. Remove a section from the side of the plug large enough to house the resistor and capacitor.
2. Insert the neon lamp into the

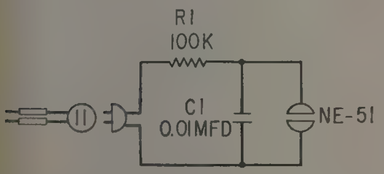
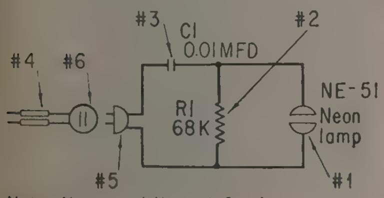


FIG. 1—60-Cycle Indicator. When the test leads are applied across 117-volt 60-cycle source C1 has a value of about 250k ohms. Because of the voltage divider (R1-C1), the voltage across the neon lamp will be about 80 volts. Since the lamp glows at approximately 50 volts rms, the presence of a 60-cycle voltage is indicated. If the test leads are applied across a 117-volt 400-cycle source, C1 would then have a value of 40k ohms. The voltage across the lamp will be about 33 volts. And this is not high enough to cause the lamp to glow, which indicates the absence of a 60-cycle source.



Note: Numbers 1 through 6 refer to parts list below.

FIG. 2—400-Cycle Indicator. When the test leads are applied across a 117-volt 400-cycle source, the voltage across the neon lamp will be about 74 volts. The lamp will glow indicating a 400-cycle source. On the other hand, if the test leads are applied across a 117-volt, 60-cycle source, only 25 volts will be across the lamp. As a result, it will not glow.

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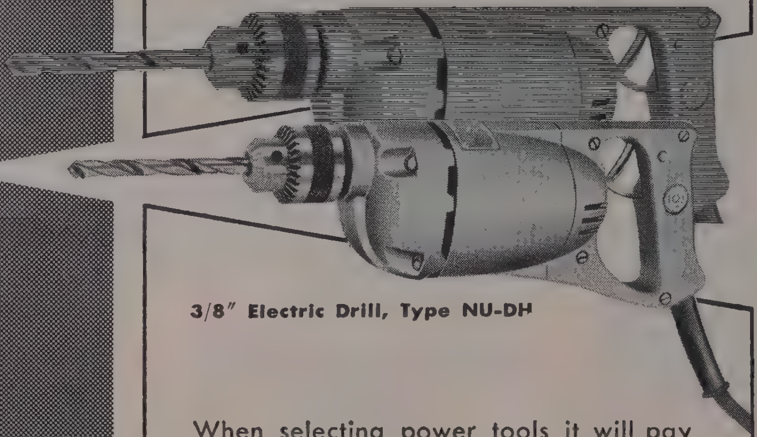
HITACHI

ELECTRIC TOOLS



3/8″ Electric Drill, Type NU-DH

When selecting power tools it will pay to consider the trouble-free Hitachi line, for they are backed by forty years' experience as well as their famous name. Hitachi produces 75% of Japan's power tools, which are exported to Southeast Asia, South America, and other destinations.

Portable Electric Drills
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Portable Electric Grinders
Electric Bench or Floor Grinders
Toolpost Grinders
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Electric Resinoid Grinders
Electric Sanders
Electric Orbital Sanders
Electric Line Sanders
Portable Electric Polishers
Electric Bench Polishers
Electric Tappers
Electric Screw Drivers
Electric Nut Runners
Electric Nibblers
Electric Hand Shears
Electric Jigsaws
Electric Circular Saws
Portable Electric Planers
Portable Electric Blowers
Electric Drill Kit
Drill Chucks

Hitachi, Ltd.
Tokyo Japan
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handle with the tip just protruding from the end.

3. Insert the resistor and capacitor into the side of the plug.

4. Solder all leads after making connections according to the appropriate wiring diagram.

5. Solder the test leads to the pigtail of the receptacle.

6. Insert the plug into the receptacle and tape together with electrical tape.

7. Continue taping to cover the cut-out in the side of the plug.

8. Mark each unit with its correct operating frequency.

Switch from Gas to Electric Operation Saves 65%

Up until last year, Rosey Tire and Retreading Co. of Los Angeles did a modest business with two steam-heated vulcanizing models, but business came to a sudden halt when the gas-fired steam generator exploded.

To avoid the possibility of another similar incident, Maurice Rosenberg, the owner, decided to "go electric" and he now has a 5-mold 18-amp 220-volt machine in his shop. This switch from gas to electric operation was dictated solely by safety considerations but, after five months, he is enthusiastic about resultant economies and a better product.

Prior to the fire, average monthly

ELECTRIC RETREADING UNIT, consisting of five 220-volt temperature-controlled vulcanizing molds, replaced gas-fired steam generating unit in Los Angeles tire shop. Owner Maurice Rosenberg claims that electric equipment is cheaper to operate, cleaner, occupies less space, produces a better product, is cooler, more flexible, has a longer life and requires less maintenance.

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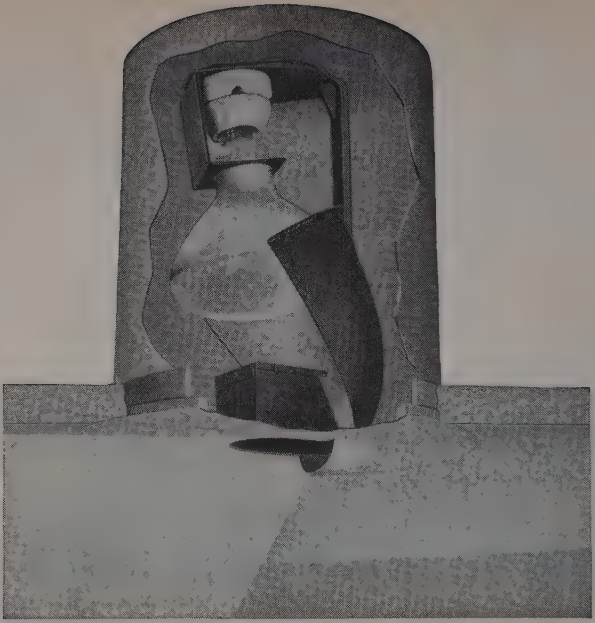

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lighting

KLIEGL BROS.

UNIVERSAL ELECTRIC STAGE LIGHTING CO., INC.

321 W. 50th ST., NEW YORK 19, N.Y.

ORIGINATORS AND MANUFACTURERS OF KLIEGLIGHTS

gas bills amounted to $27, while water for the steam generator added $4 and "incidental" electricity amounted to $8; indicating a utility charge of $19.50 per month per mold.

Now, with electricity as the only utility involved, average monthly bills are $27.50. And, with five molds in operation instead of two, the resultant per-mold charge has been reduced to $5.50, a substantial saving over gas.

Reducing these charges further to a cost-per-tire basis, the gas-steam cost was 12½ cents compared to the present cost of 3.6 cents, a 65% reduction.

In addition, the owner claims that:

1) Without the boiler, steam and condensation piping, electric equipment occupies considerably less space.

2) Constant mold temperatures were difficult with the former equipment, while uneven heating, caused by "blows," resulted in about 5% of the operations. Cold spots created by condensation of steam resulted in customer complaints and rejects, necessitating replacement of defective tires under a guarantee arrangement. With electric units, full temperature control is now available for each individual mold. These advantages, together with an improved mold contour, result in a better product.

3) Radiation from the steam-heated unit was high. Now it is possible to rest your hand on the outside of the unit without discomfort, illustrating the factor of cooler operation made possible by electric units.

4) When a rush retreading job had to be performed over a weekend or holiday, it formerly was necessary to heat the entire steam system, requiring 1½ hours. Since electric molds are individually heated, they now come up to their operational temperature of 290 degrees in 20 minutes.

This indicates greater flexibility in operation.

5) Maintenance is reduced and guaranteed life is more readily attained.

As summarized by Mr. Rosenberg, "Electric operation not only is cheaper and cleaner, but I now can turn out a superior tire at less cost, in less time, with better bonding."

Installation of wiring and controls for the new tire equipment was made by L&M Electric Co., Los Angeles.

Now! Any old electric hammer is worth $60 or more trade-in

on a New Skil ROTO-HAMMER

..the hammer that revolutionized masonry drilling

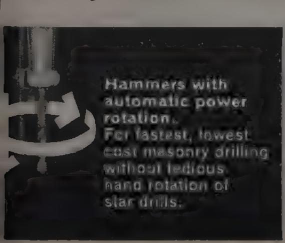
our Skil distributor is ready to give you a hopping big trade-in allowance on a new il Roto-Hammer—*the fastest, easiest, low-t cost way to drill masonry holes!* You'll tually receive $60 or more worth of Skil ammer accessories as your trade-in for y old electric hammer, regardless of make, odel or condition.

Two Roto-Hammer models are available—new, improved Model 726 (drills masonry holes from $^{11}/_{64}''$ to $1\frac{1}{2}''$ diameter); Model 736 (drills masonry holes from $\frac{1}{2}''$ to $3\frac{1}{2}''$ dia.).

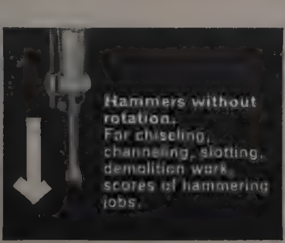
See your Skil distributor NOW for complete information. *But hurry! This sensational trade-in offer is for a limited time only!* Look under "Tools—Electric" in the Yellow Pages. Or write: Skil Corporation, Dept. 130I, 5033 Elston Avenue, Chicago 30, Illinois.

SKIL
POWER TOOLS

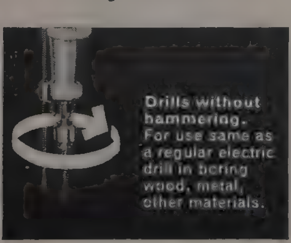
Only Skil Roto-Hammers have 3-way action



Hammers with automatic power rotation. For fastest, lowest cost masonry drilling without tedious hand rotation of star drills.

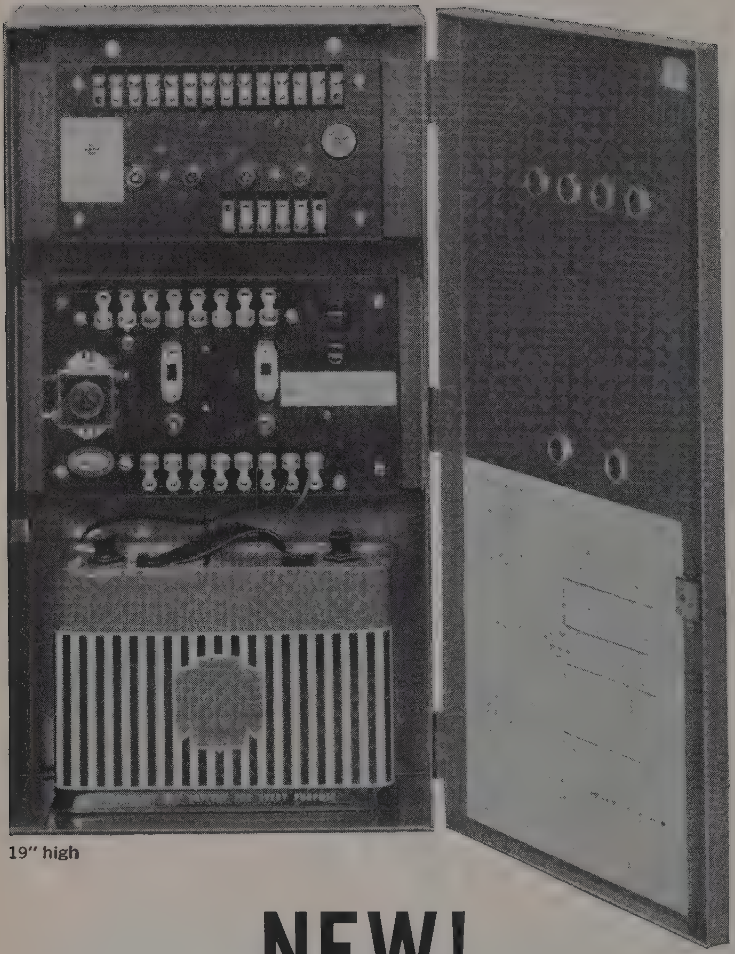


Hammers without rotation. For chiseling, channeling, slotting, demolition work, scores of hammering jobs.



Drills without hammering. For use same as a regular electric drill in boring wood, metal, other materials.

...and only Skil Roto-Hammers use 4 types of percussion-rotary bits...over 150 accessories in all for unequalled versatility!



19" high

NEW!

Fire Alarm Control Cabinet

Kidde's new compact automatic fire alarm combination panel monitors four circuits with local alarm. A one-circuit cabinet is also available with or without the 4-zone annunciator. Any number of detectors and noncode break-glass stations can be used with the new cabinet, and a locking-type alarm relay permits the use of self-restoring detectors or stations. The unit provides for two vibrating bell circuit terminals.

U.L.-approved, the new Kidde unit draws power from any 120 volt AC source and converts it to 6 volts DC for operation. In case of power failure, a trouble alarm sounds, and the entire system automatically transfers to self-contained battery operation. For more information, write to Kidde.

Kidde

Kidde Ultrasonic & Detection Alarms Division, 985 Brighton Road, Clifton, N. J.
Walter Kidde & Company, Inc.

REMOTE METERING SYSTEMS

[FROM PAGE 118]

ditions. In such a case, the neutral is a current-carrying conductor under balanced and unbalanced loading. However, when large blocks of kva are distributed by a common feeder—either 3-wire, single-phase of 3-phase, 4-wire—all phases are carried with the neutral and neutral capacity can be reduced from that of the phase conductors because of the improbability that the operating system will ever find one phase fully loaded and the other phases unloaded.

Of course, the big advantage in a common feeder over individual feeders—or the big advantage of master metering over unit metering—is in the reduced demand on a common feeder. If, for instance, such demand on a common feeder was 50% (or 35 or 25%, according to the NE Code) of the sum of the demands of subfeeders supplied by the feeder, the cost of distribution for an individual metering job over a master metering job might run up to a 100% increase.

In many systems where individual metering is required, design of the distribution layout does take limited advantage of common feeders. For instance, a common feeder for each floor may be run to a meter bank on each floor, or a common feeder for three floors may be run to every third floor starting with the second floor where the meter bank serves three floors of apartments. Then a separate subfeeder for each unit occupancy is derived through a meter. However, this system still falls short of ultimate economies available if conventional unit metering were dispensed with.

In view of all of the foregoing, the new system of remote metering has much to offer in the way of providing for individual metering while permitting a distribution system with no restrictions on its design. Remote metering provides individual-occupancy metering at the distribution cost of a master metering layout.

One of the most important applications for this new metering system, in addition to new construction, is in cases where an existing master-metering installation is to be converted to individual submetering. The new method permits such change without any alterations in existing distribution.

Why you should SPECIFY SEALTITE by ANACONDA

to protect electrical wiring

You know the trouble spots in plants where electrical wiring has to be protected against hazards. Perhaps you've spotted the problem as moisture . . . oil . . . vibration . . . chemical fumes . . . dust . . . corrosion. If you recommend that the wiring be enclosed in SEALTITE, then you know it's protected by the best flexible electrical wiring conduit available. Its strong galvanized steel core is protected by a tough polyvinyl chloride cover. Extreme flexibility permits installation in cramped quarters . . . and in installations that must hug contours. Easy to work with, too. Specify the original, the best. It costs no more. Available from leading electrical wholesalers. For new SEALTITE bulletin S-544, write to Anaconda Metal Hose, P.O. Box 791, Waterbury 20, Conn.

61-942

SPECIFICATIONS

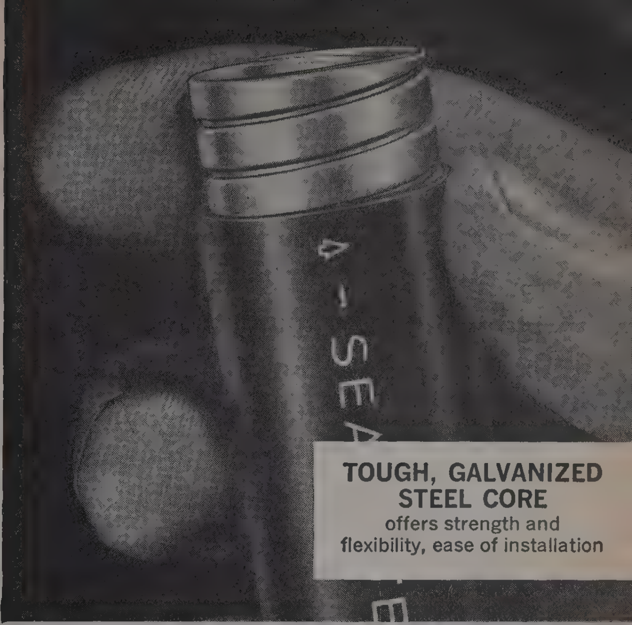
	Trade Size (In.)	INSIDE DIAMETER		OUTSIDE DIAMETER		Approx. Inside Bend Diam. (Inches)	Feet Per Std. Coil	Approx. Shipping Wgt. (Lbs.) Per Std. Coil	Feet Per Std. Reel	Approx. Shipping Wgt. (Lbs.) Per Std. Reel
		Min.	Max.	Min.	Max.					
TYPE UA	3/8	.484	.504	.690	.710	6	200	60	1500	460
	1/2	.622	.642	.820	.840	7	200	70	1000	365
	3/4	.820	.840	1.030	1.050	10	150	70	850	420
	1	1.041	1.066	1.290	1.315	13	100	90	600	525
	1 1/4	1.380	1.410	1.630	1.660	16	50	70	375	430
TYPE EF	3/8	.485	.505	.690	.710	4	250	60	1500	390
	1/2	.620	.640	.820	.840	5	200	60	1000	325
	3/4	.815	.835	1.030	1.050	6	175	70	850	375
	1	1.030	1.055	1.290	1.315	8	100	60	600	420
	1 1/4	1.370	1.395	1.635	1.660	9	100	80	375	360
	1 1/2	1.575	1.600	1.875	1.900	11	50	55		
	2	2.020	2.045	2 350	2.375	14	50	75		
	2 1/2	2.480	2.505	2.850	2.875	19	50	105		
	3	3.070	3.100	3.470	3.500	23	25	80		
	4	4.000	4.040	4.460	4.500	28	25	105		

SEALTITE®

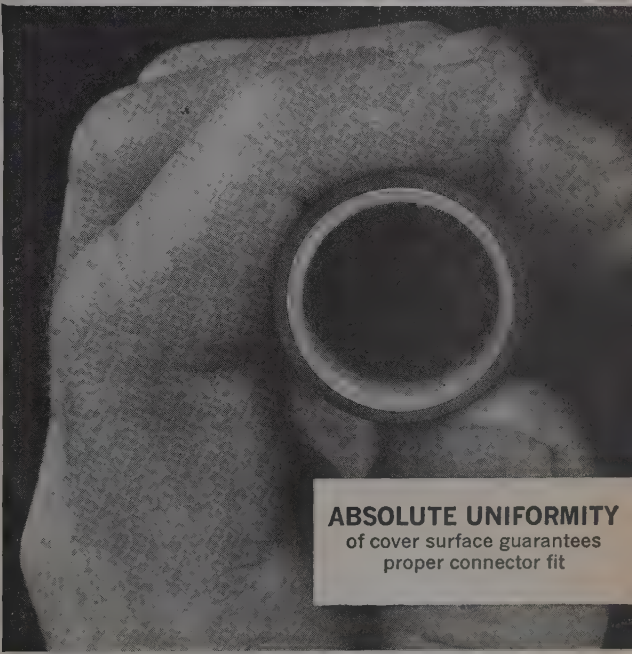
a product of

ANACONDA®

METAL HOSE DIVISION



TOUGH, GALVANIZED STEEL CORE
offers strength and flexibility, ease of installation



ABSOLUTE UNIFORMITY
of cover surface guarantees proper connector fit

STANDARD CONNECTORS
have been designed by leading manufacturers to Sealtite specifications. They're liquid-tight, hold securely

It moves

. . . powered and controlled by Westinghouse

Press a button—an indoor auditorium becomes an open
stadium in 2½ minutes—and behind that button is an
paralleled story of engineering and construction cooperati
Architectural and engineering teamwork has given Pi
burgh the world's first movable roof auditorium. T
versatile structure adds to the city's renaissance, in
building, a 14,000 seat sports arena, a convention h
open air amphitheater, and an exhibit center. Westingho
products bring the facilities to life, give precision control
the delicate manipulation of six 300-ton movable leave
Outwardly, the new auditorium is a 400′ stainless s

J-94

mbrella, suspended from a space frame cantilevered from he ground. That is one outstanding construction teamork story.

Inside, coordination culminates in a control console ocated high above the seating area. From this station the

---

onstruction Motivators: The Authority & Industry
to r seated: Judge A. L. Wolk, Vice Chmn.; N. Stabile, Sec'ry Treas.;
W. B. McFall, Chairman; H. R. Edelman, Jr., Pres. Heyl & Patterson;
nd D. J. McDonald, Vice Chmn.
tanding: C. B. Jansen, Member; J. E. Payne, V. P. Westinghouse; and
dw. Fraher, Exec. Director

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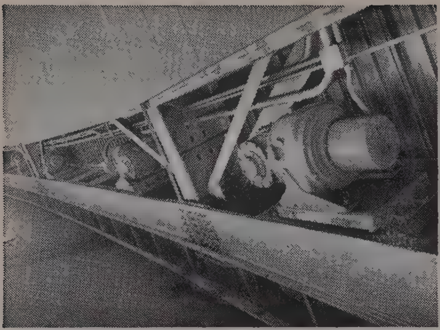

The six movable roof leaves are driven by Westinghouse right angle gearmotors, five to each leaf. Photo shows base of one of the movable leaves with the acoustic ceiling panels removed.

O. M. Newman, Heyl & Patterson, and Edward Cohen, Amma & Whitney, discuss roof electrical drive with C. G. Falkenstein, We inghouse, kneeling in front of main roof reactor control cabinet.

unique movable roof drive system is activated. An A reactor control scheme keeps all six movable leaves in st throughout open and close cycles. Each leaf is driven Westinghouse Moduline® gearmotors, with opposite leav being operated in pairs.

Close cooperation among architects, engineers, owne contractors and Westinghouse helped to provide a syste flexible enough to serve varying building demands, wi the high degree of electrical reliability required.

For more complete information on the electrical aspec of construction, write to: Westinghouse, P. O. Box 86 Pittsburgh 30, Pennsylvania.

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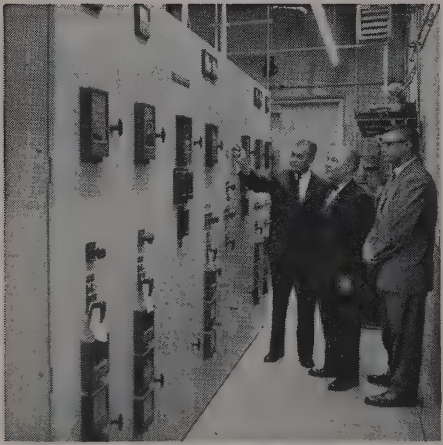


5KV metal-clad switchgear contains a tie-breaker to provide emergency switching between two incoming 4160-V lines. Seen here: N. J. Grady, V. P., Ernst, C. J. Long, and A. B. Janaszek.

Checking construction progress are C. J. Long and F. J. Sarkn Westinghouse. In background, 1500 kva power center supplies pow for building auxiliary and air conditioning compressor motors.

Westinghouse Motor Control Center located in the Mechanical Room centralizes auxiliary motor controls. Discussing installation advantages are H. R. Helvenston, C. J. Long and N. J. Grady.

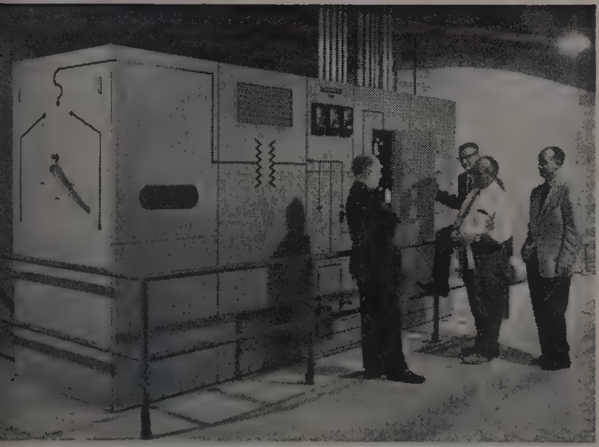
Three 125 hp Lifeline A motors drive freon compress to chill brine supply for ice rink piping. Seen here are F. Schad, Limbach, and C. G. Falkenstein, Westinghou

Operator's view from roof control console high above the spectator area. Visible through the glass front is the juncture of the first two movable leaves of the roof.

One of main power transformers rated 2500 kva at 11.6 kv to 4160 volts. Discussing the power supply are C. J. Long, Electrical Engineer, M. A. Geffel, Ernst, and A. B. Janaszek, Westinghouse.

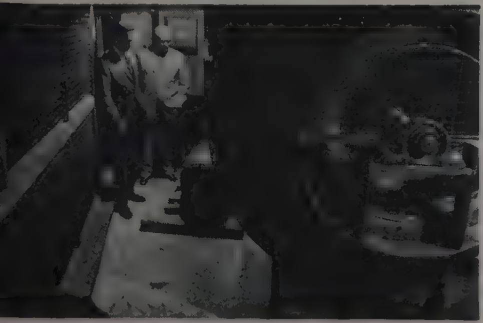
uilder: Public Auditorium Authority of Pittsburgh & Allegheny County: *Resident Engineer & Supt. of Construction:* H. Rey Helvenston
rchitects: Mitchell & Ritchey, Pittsburgh
oof Designers & Engineers: Ammann & Whitney, N.Y.
lectrical Engineer: Carl J. Long & Associates, Pittsburgh
echanical Engineer: John Mullin & Associates, Pittsburgh
eneral Contractor: Dick Corporation, Large, Pa.
lectrical Contractor: E. C. Ernst, Inc., Pittsburgh
echanical Contractor: Limbach Company, Pittsburgh
rive System Contractor: Heyl & Patterson, Inc., Pittsburgh

Westinghouse

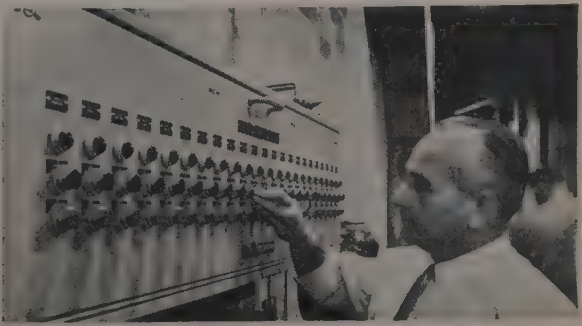


nother Westinghouse power center, this 300 kva ASL dry type pplies lighting and auxiliary power. Discussing its component parts re C. J. Long, A. B. Janaszek, M. A. Geffel and Albert Simon, Ernst.

Type M Electric Stairway transports 8,000 persons /hr. Top to bottom: E. R. Gallagher, supervising architect; H. R. Helvenston, resident engineer; and A. Simmonds, Westinghouse Elevator.

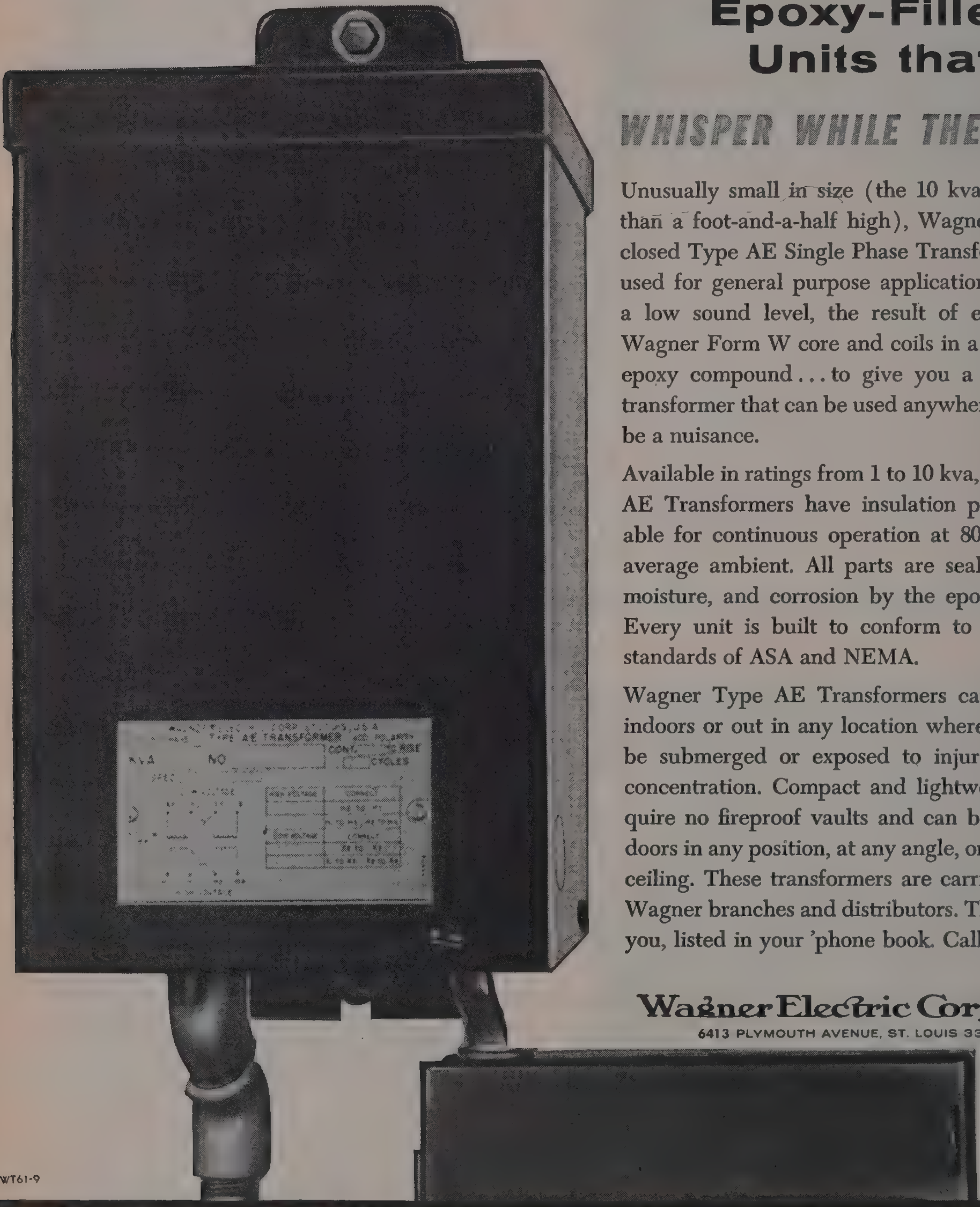


an room equipped with series 8000 Air-Foil centrifgal fan and air conditioning coils. W. Y. Humphreys, estinghouse, with John Mullin, Consulting Engineer, conditioning and ventilation system designer.



Westinghouse mercury vapor parking area and floodlighting are operated from this remote control panel located in the mechanical room. M. A. Geffel, Ernst, tests lighting circuits.

WAGNER® DRY-TYPE GENERAL PURPOSE TRANSFORMERS



Compact Epoxy-Filled Units that

WHISPER WHILE THEY WORK

Unusually small in size (the 10 kva rating is less than a foot-and-a-half high), Wagner® totally-enclosed Type AE Single Phase Transformers can be used for general purpose applications. They have a low sound level, the result of encasing small Wagner Form W core and coils in a solid block of epoxy compound . . . to give you a whisper-quiet transformer that can be used anywhere noise would be a nuisance.

Available in ratings from 1 to 10 kva, Wagner Type AE Transformers have insulation protection suitable for continuous operation at 80°C in a 30°C average ambient. All parts are sealed from dust, moisture, and corrosion by the epoxy compound. Every unit is built to conform to all applicable standards of ASA and NEMA.

Wagner Type AE Transformers can be installed indoors or out in any location where they will not be submerged or exposed to injurious fumes in concentration. Compact and lightweight, they require no fireproof vaults and can be mounted indoors in any position, at any angle, on wall, floor, or ceiling. These transformers are carried in stock at Wagner branches and distributors. There's one near you, listed in your 'phone book. Call or write now.

Wagner Electric Corporation
6413 PLYMOUTH AVENUE, ST. LOUIS 33, MO., U.S.A.

WT61-9

SPECIFICATIONS

Type AE—Single Phase—1 to 10 Kva 80° C Rise, 60 Cycles.

High Voltages: 120 x 240; 240 x 480; 600 volts, no taps; 480, 600 volts, 2—5% taps below normal.

Low Voltage: 120/240 volts.

KVA	DIMENSIONS IN INCHES			NET WEIGHT POUNDS	AVERAGE SOUND LEVEL DECIBELS
	Height	Width	Depth		
1	10 13/16	6 5/16	6 3/16	28	37
1½	11 13/16	6 5/16	6 3/16	34	38
2	13⅛	6 13/16	7 3/16	46	38
3	14⅛	6 13/16	7 3/16	62	39
5	15 9/16	9¾	9¼	93	39
7½	16 1/16	9 11/16	10 7/16	130	39
10	17⅛	11⅛	10¼	167	39

FORK EXTENSION brushes rings, that support power cable along adjacent messenger wire, thereby preventing looped cable from entanglement with hoist chain or wheels or rolling truck.

Simple Fork Protects Extension Cord for Hoist

Many motor shops have adopted the idea of installing a small I-beam above a work center, with a motorized chain hoist supported by a 4-wheeled truck rolling along the topsides of the beam's lower flanges. Many such installations also make use of adjacent messenger cables, with small rings spaced along the cable to support a hoist-powering extension cord at intermittent points.

This combination makes it possible for a shop employee to move the hoist along the beam to any desired position, although there is a tendency for the extension cord to festoon and lag behind the hoist's direction of travel. When the hoist is moving away from the remote source of power, which is usually located at one end of the beam, the trailing extension cord poses no particular problem. However, when the hoist is being moved along the beam in the opposite direction, that is, toward the connection point of the power cable, the extended festooning of cable along the length of messenger wire can often result in snarling or even entanglement with the hoist chain or truck wheels.

To eliminate this possibility, the operators of the San Jose Armature and Motor Works, San Jose, Calif., attached a small right-angle bracket to the rolling truck, then welded to it a forked arm that extends slightly beyond, above and below the adjacent messenger wire. With this simple device, rings supporting the extension cable are brushed along the wire as the hoist is moved towards the source of power, and the looped power cord is thereby kept free from hoist and truck mechanisms.

Combination Burn-Bake Electric-Gas Oven

For a small shop where space is at a premium and the volume of work is insufficient to justify an elaborate layout of specialized equipment, a combination burn-and-bake oven such as one used by Conrad Electric of Oakland, Calif., is a practical space saver and multi- purpose facility. In this enclosure, insulation on coils to be stripped may be burned by means of a centrally placed gas cap, while freshly applied varnish may be subsequently baked in the same oven with regulated heat supplied by six 1000-watt electric strip units mounted along the sides of this practical assembly.

Electric heat is regulated by means of a thermostatic control secured to the rear panel, while baking cycles may be terminated by a clock-activated control switch. This combination rig has several advantages because, in addition to conserving floor space in the shop, the single enclosure requires only one exhaust system to serve these two operations.

RADIANT ELECTRIC strip heaters are mounted on walls of this combination oven to supply heat for baking, while a central gas nozzle serves as burning medium when coil insulation is to be charred and stripped prior to the rewinding of a motor.

AIR LINES and electrical conduit are contained within hollow fireproofed bulkhead located between paint booth and storage area, while spray guns and containers are supported by hooks on the bulkhead jamb.

Spray Booth and Locker Have Mutual Bulkhead

A metal-sheathed hollow bulkhead between a paint spray booth and an adjacent paint storage locker serves as a protected enclosure for the containment of air lines and distribution conduit related to spraying, lighting and exhaust equipment in the shop of the Kuchel & Sievers Electric Works, San Francisco. The booth (left) is also equipped with varnish-dipping and grease-solvent tanks, so that dripping is confined within a single fireproofed area, while vaporproof lighting and a large-capacity vented exhaust fan insures a bright, fume- and odor-free environment in which to work. Containers and spray guns related to several colors of enamel and paint are conveniently supported by hooks located on the front jamb of the common bulkhead, while switches for lighting and exhaust installations are placed on the locker (right) side, thereby minimizing the possibility of contamination by fumes or spray.

Infrared Rigs Deliver Concentrated Heat

Lindstrom, Inc., of San Francisco, utilizes a wide assortment of infrared baking rigs, the majority

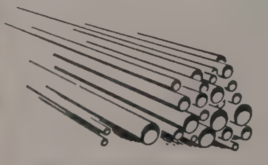
Why Not **KRALOY CONDUIT?**

Corrosive gases, liquids, vapors or electrolytic action will not corrode a Kraloy Rigid PVC raceway. Kraloy is from 18% to 30% faster to install than any metallic conduit, and conductor pulling requires far less time and energy. Conductors are more than amply protected from crushing and impact. Conduit is U/L listed for underground burial or encasement in concrete, will not support combustion, and will not spark.

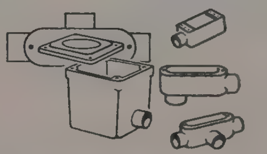
Your Kraloy electrical distributor will elaborate on the above features . . . or write

Kraloy/Chemtrol Co., Electrical Conduit Division, 402 W. Central Ave., Santa Ana, Calif.

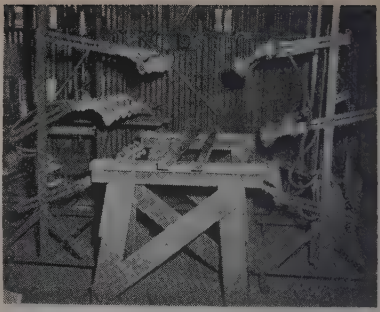
QUALITY PLASTIC PRODUCTS FOR INDUSTRY
KRALOY CHEMTROL CO.
SANTA ANA — PHILADELPHIA — DALLAS



KRALOY ELECTRICAL CONDUIT



KRALET ELECTRICAL ACCESSORIES



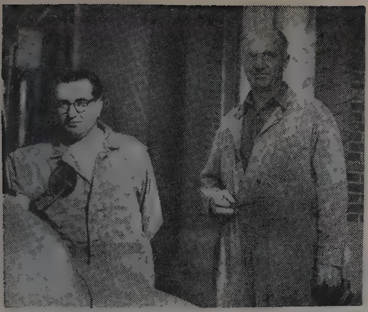
SLOTTED ARMS placed in desired positions by easily secured wing nuts, hold infrared lamps close to work being subjected to concentrated heat treatment. Entire assembly may be covered with asbestos blanket to minimize heat dissipation to shop area generally.

being portable so that heat may be positioned and concentrated upon specific work areas without having to move heavy or awkward assemblies into location-fixed and confined baking ovens.

Some indication of these flexible baking rigs is given in the above photo, which shows banks of heat lamps supported by horizontal channel members that may be rotated, raised or lowered, or moved inward or outward by means of related slotted arms. Wing nuts lock arms in desired configuration to vertical standards, while standards may be positioned-at-will due to castered pedestal construction.

In this case, sections of steel angles are placed atop wooden horses to support a unit to be baked, then lamp-supporting arms are positioned to form a cylindrical grouping around this intended baking center. Since connecting cords are long, flexible and durably insulated, and since switching permits flexible control of desired number of lamps, this rig and many others of similar design are useful tools in this busy shop.

SAN JOSE Armature and Motor Works, Calif., owned and operated by Al Nelson and Walter Thomas Jr., is an active sales-service organization handling power tools and welding equipment in addition to all types of motors and controllers.

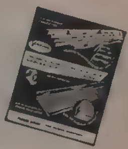


STANDARD ELECTRIC & Engineering Co., San Francisco, is owned and operated by the father-and-son combination of Pompey (right) and Bob Scribante, who have built and maintained a reputation for quality motor service through a policy of consistent attention to details.

Air Cutter Nips Coils

Prior to stripping damaged coils from stator slots, shop employees of the California Electric Co., Oakland, first cut through coil loops around one end of the frame. Then, after charring coil insulation in a burning oven, unsevered loops are grasped and pulled free with tong clamps. Cutters and tongs alike are given power by plunger cylinders activated by foot-pedal pressure. And, when operated by an experienced worker, these useful devices are high-calibre time savers. Since the cutter shown is mounted atop a knee-high concrete pedestal, and since cutting action is controlled by foot pressure, the operator can keep both hands free, at a convenient level, to manipulate the stator being reconditioned.

FAST ACTION by foot-controlled plunger-powered cutting blades speeds severing of coil loops prior to insulation-charring and coil-stripping operations.



NOW···GLOBE OFFERS···
two new INTERCHANGEABLE trays
for support of cables, wiring and tubing

★ Engineered for uniform design and easy installation
★ Steel or aluminum construction
★ Complete accessories for SPEEDIER Installation
★ No sharp edges to damage cables
★ Complete interchangeability

Now, for the first time, two types of cable trays, one a ladder type and the other a basket type, are available to be used INTERCHANGEABLY at any given location, depending on the type and weight of the cables to be suspended. The advantages of each type tray can thus be used to the fullest extent. Globetray, the ladder type, is intended for use where festooning is not a problem, while Cable-Strut, the basket type, is intended for the support of communication wire, instrument tubing and control cables in automation applications.

These two cable trays have been thoroughly field tested in hundreds of large industrial installations, in new plant construction, in power plants, in modernization, and for power distribution in all types of manufacturing processes. A new catalog, just off the press, gives full information and installation techniques. Ask for your FREE copy today.

Distributors are to be found in all principal cities—consult the yellow pages in your phone book under "Gratings" or "Conduits" for the one nearest you.

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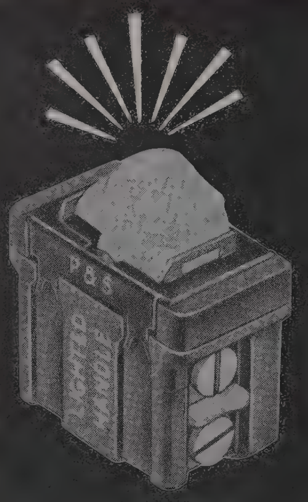
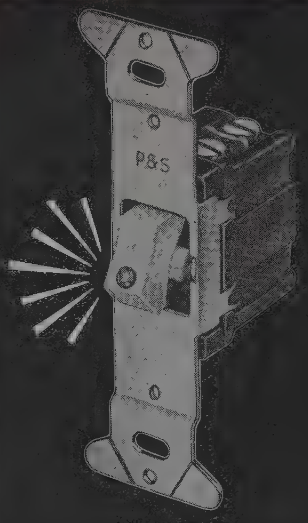
3 NEW *P&S ROCKER-GLO SWITCHES!*



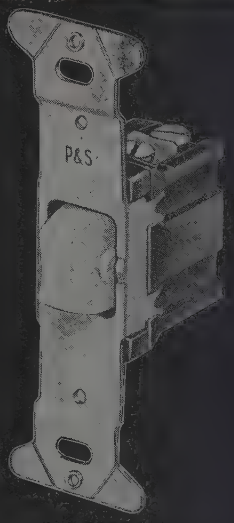
No. 2211-SL

No. 2211-SL also available in strap type No. 2221-SL



No. 2221-SP

No. 2221-SP also available in Despard (interchangeable) type No. 2211-SP



No. 2225-S

No. 2225-S also available in Despard (interchangeable) type No. 2215-S

1

LIGHTED HANDLE ROCKER-GLO

Pinpoints switch location in darkened rooms or hallways. Tiny, long-life neon lamp softly glows in OFF position only. Single pole or three-way. Rating: 15 Amperes, 120 Volts, A.C.

2

Pilot Light HANDLE ROCKER-GLO

Instantly shows when appliances or lights are on. Tiny red plastic jewel in rocker button lights in ON position only. Single pole only. Rating: 15 Amperes, 120 Volts, A.C.

3

REMOTE CONTROL ROCKER-GLO

Momentary contact, center "off" switch. Designed especially for low voltage remote control applications—controlling large banks of lighting, operating stage curtains, etc. Single pole, double throw. Rating: 10 Amperes, 48 Volts, A.C.

For more information write Dept. ECM961

P&S PASS & SEYMOUR, INC.
SYRACUSE 9, NEW YORK

60 E. 42nd St., New York 17, N.Y. 1440 N. Pulaski Rd., Chicago 51, Ill. In Canada: Renfrew Electric Co., Ltd., Toronto, Ontario

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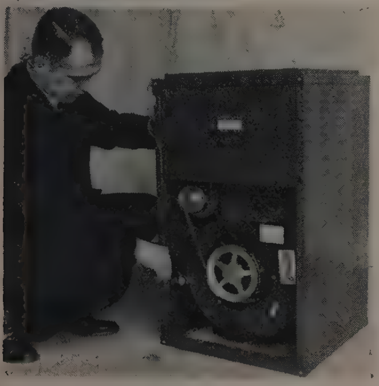
Product News

Lighting Fixture (1)

A new "Trim/Line" outdoor lighting fixture features six ultra high output type, 1500 ma lamps. Fixture housing is all-aluminum and measures 3¾ in. high. The flat silhouette lends itself to both new construction and modernization. Furnished in 4-, 6- and 8-ft lengths, unit is also available in 4-lamp models. Fixture features a hinged door assembly constructed of anodized aluminum extrusions and clear acrylic plastic. Ballasts are 1500 ma outdoor, non-weatherproof type, high power factor, suitable for starting and operating at low temperatures. They are mounted in overhead channel. Adjustable pole adapter allows vertical adjustment of fixture from horizontal to 45° above horizontal, and sideways adjustment from a horizontal plane to 30°.

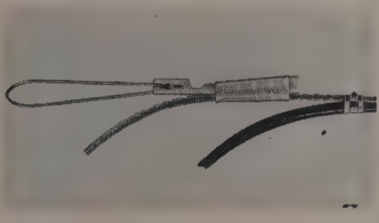
Guardian Light Company, 500 *North Blvd., Oak Park, Ill.*



Electric Furnace (2)

A thermostat-controlled, forced-air electric furnace maintains even temperatures without recycling through the use of a "sequencer" control unit. Furnace is available in two cabinet sizes and six heat ratings from 34,000 to 119,000 Btu's. The 34,000-Btu model uses two elements and the highest rated 119,000-Btu model requires seven elements. The "sequencer" control unit, which may control up to seven heating elements depending upon furnace rating, energizes only enough elements to supply the heat needed to satisfy the thermostat setting. Completely enclosed and insulated with 1-in. thick vinyl-coated glass wool, furnace can be operated vertically, horizontally, or upside down with only a minor change in the placement of controls.

Westinghouse Air Conditioning Div., P. O. Box 510, *Staunton, Va.*



Clamp (3)

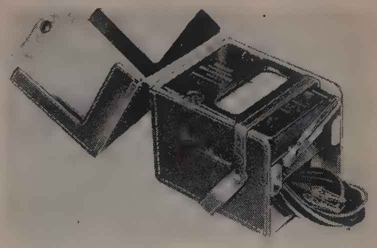
An all-aluminum wedge clamp for aluminum neutral messengers at service dead-ends. Construction is heavy-gauge, high-strength aluminum alloy, with flexible nylon-jacketed bail or rigid stainless steel bail. Design of clamp eliminates need to thread cable through clamp. Because slider is removable, clamp can be installed anywhere on a continuous run of conductor. Wedging action grips tightly along entire length of contact. Only four sizes of new clamp are needed to dead-end a range of cables from No. 6 solid through No. 4/0 ACSR.

Jasper Blackburn Corp., 1525 *Woodson Rd., St. Louis* 14, *Mo.*

Lamps (4)

A new series of 3-way and "Hi-Lo" 2-way incandescent lamps has been announced. Principal features of the new multi-level types are vertical filament construction and a new tapered base construction. The axial, or vertical, construction includes a "coiled coil" filament. The "Kon-Tact" base has a tapered contact ring. The 3-way lamps are available in the 50/100/150-watt range, inside frosted, and in the 30/70/100, 50/100/150, 100/200/300-watt ranges in soft white finish.

Lighting Products Div., Sylvania Electric Products Inc., Salem, Mass.



Tester (5)

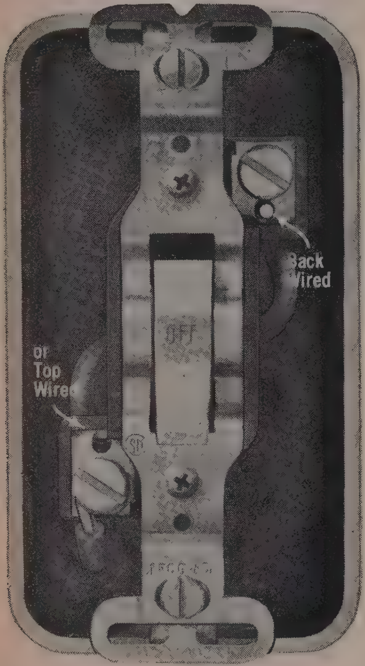
A new Mark III Megger insulation tester has been announced. Three ranges of instruments are available: 100 volts dc, 0.02-20 megohms; 250 volts dc, 0.05-50 megohms; 500 volts dc, 0.1-100 megohms. Each of these models is also available with the added feature of a double scale and selector switch for 0-10,000 ohms. The single scale, 500-volt model is for testing house wiring, domestic appliances, portable tools, etc., operating on 115 and 230 volts. The 250- and 100-volt instruments are for lower voltage circuits. Bulletin 21-85-6 is available.

James G. Biddle Co., 1316 *Arch St., Philadelphia* 7, *Pa.*

Switches (6)

Announcement has been made of the addition of new operators and optional features to this line of Type L precision oil-tight limit switches which provide flexibility of application. Nine new Type L limit-switch operators and switches consist of: roller lever with metal roller; roller lever with 1-in. wide roller; adjustable roller lever with 1½-in. diameter roller; adjustable spring rod actuator; adjustable nylon rod actuator; duplex limit switch; wobble stick with 12-in. wire extension; cat whisker operator; and precision adjusted roller lever available with either a metal or a nylon roller.

Cutler-Hammer Inc., 315 *North* 12*th St., Milwaukee* 1, *Wis.*



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TESTED
AT OUR FACTORY—
NOT IN YOUR BOX

Some year's ago Sierra began the unprecedented procedure of testing each and every Mercury Switch under load conditions. Sierra has always contended that the place to verify a product's performance is at the factory—not after you get it in the box.

Sierra Mercury Switches are available in 1- & 2-pole, 3- & 4-way; and Sierra-lite with neon-lighted toggle handle.

SIERRA
ELECTRIC
CORPORATION
15100 SOUTH FIGUEROA STREET
BOX 85, GARDENA, CALIFORNIA

Write for more information and catalog

Magnetic Starters (7)

Flush-mounted magnetic starters for the machine tool industry and contractor installations have been added to the G-E 100 line of motor controls. Available for cavity mounting in machinery or for mounting in plaster walls, the new forms are rated up to 600 volts, 60 to 25 cycles in NEMA Sizes 0, 1 and 2. For machine tool applications, starter can be furnished with a mounting bracket and front cover. When rigid conduit or BX cable is used, bracket is eliminated and starter is furnished mounted in an enclosure. Starters for mounting in plaster walls include a bracket, box and front cover. Box is mounted in wall prior to plastering like any wall conduit box. All forms are supplied with combination knockouts—two each at top, bottom and sides, and four in back.

General Electric Co., Schenectady 5, N. Y.

M-V Lighting Equipment (8)

A new line of mercury-vapor explosion-proof lighting equipment for hazardous locations. Available in two basic sizes to accommodate 250- and 400-watt mercury-vapor lamps, fixtures can be obtained in pendant, ceiling, bracket or flush concrete mounting type arrangements. Construction is copper-free aluminum castings with steel porcelain enamel reflectors of various types. Clear globes are available in either smooth or fluted or prismatic style.

Killark Electric Manufacturing Co., 3940 *Easton Ave., St. Louis* 13, *Mo.*

Oil Cutouts (9)

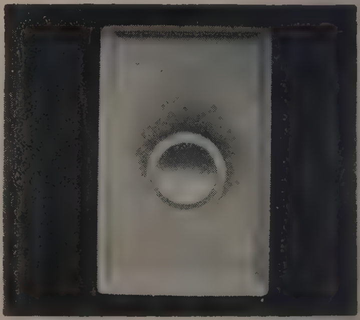
A 15-kv sealed oil cutout, coupled with present 5.2- to 15-kv vented and sealed units, form a complete line of oil cutouts. Both sealed and vented cutouts in 5.2 to 15 kv are now offered to provide positive load-break operation and overcurrent protection on electric utility and industrial plant distribution systems. Sealed units should be used only in hazardous atmospheres or where there is a possibility of submersion. Vented units are recommended for all other installations such as substations, commercial and industrial buildings, shopping centers and schools. They can be used for load-switching on transformers, in metal-enclosed assemblies or in rack-mounted installations.

General Electric Co., Schenectady 5, *N. Y.*

Transistor Timer (10)

A new Atcotrol series 308 miniature transistorized timer for time control for laboratory and industrial process has been developed. Extended life is assured through the use of a simple timing network which has no moving parts or tubes. A filtered power supply working through a transistor operates a 2-pole double-throw mercury wetted relay. Through use of a transistor, immediate operation is possible. Load contact rating is 5 amps at 115 volts ac, non-inductive. Power requirements are 115 volts, 50/60 cycles; or 230 volts, 50/60 cycles. Timer may be flush panel mounted or surface mounted with available brackets.

Automatic Timing Controls, Inc., King of Prussia, Pa.



Dimmer (11)

The "Dimitron" provides four-stage lighting in standard wall box. Full lighting range may be dialed within a convenient one-quarter turn; off, 20% (Soft-glo), 50% (Glamor-glo) and 100% illumination (High-glo). The exterior is designed in gold and cream-beige. The electronic Dimitron controls up to 400 watts, incandescent only, with no interference to radio or television reception.

Lutron Electronics Company, 230 *Fifth Ave., New York* 10, *N. Y.*

How You Can Eliminate Fluorescent Ballast Noise Problems in Your Buildings

Today's trend toward higher levels of illumination—increasing the number of fixtures, lamps, and ballasts, or increasing the wattage of the lamp/ballast systems—makes fluorescent ballast sound a more and more important building consideration.

General Electric wants you to take full advantage of modern lighting levels. At the same time, you should assure yourself that you can solve any audible ballast "hum" problems in your lighting installation with minimum attention and effort.

ALL YOU HAVE TO DO IS . . .

1. Check each lighting installation *while it is still on the drawing board* with the General Electric Sound Rating Calculator* (see below) to predetermine whether ballast noise will be a problem, and . . .
2. Specify the appropriate *General Electric* sound-rated ballasts for the installation.

That's it. By properly following this two-step procedure, you can predict and overcome potential ballast noise problems before they exist.

General Electric, with five years of highly successful experience in the G-E Ballast Sound-control Program, is confident that this procedure will solve your ballast noise problems. Here's how the program works . . .

THE GENERAL ELECTRIC BALLAST SOUND RATING CALCULATOR is based on data gathered from hundreds of lighting installations over a period of many years. It provides a reliable index of the magnitude of audible ballast sound when room variables such as size, ceiling materials, and number of fixtures and ballasts are known. These calculations are keyed to . . .

GENERAL ELECTRIC'S BALLAST SOUND RATING SYSTEM. This system, initiated by General Electric in 1951, establishes a rigid scale of sound magnitude. Most General Electric ballast designs are carefully compared with this scale in actual fixture tests conducted in the only known anechoic sound chamber in the ballast industry. Each ballast design is thus "Sound-rated" "A" through "F," . . . "A" being quietest, and "F" being least quiet.

The sound-rating scale—and for that matter, the whole sound-control program—is not an industry standard. General Electric has established its own sound standards, and compares the performance of *General Electric ballasts* with these standards.

But the Sound-control Program doesn't end here. In order to give you further assurance that you get the "quiet" you specified, General Electric has established an elaborate . . .

DAILY PRODUCTION SOUND AUDIT. A *daily* sample of production units is carefully compared in sound performance with the G-E sound-rating standard—under controlled conditions in the anechoic sound chamber. This close check on possible manufacturing variations means you get the kind of sound performance that your Sound Rating Calculator promised. The final element in G.E.'s Sound-control Program is . . .

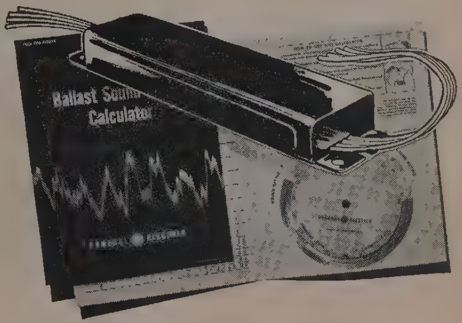
BASIC ENGINEERING DESIGN. General Electric ballast design engineers are constantly examining today's ballast circuitry, trying to further minimize the inherent magnetic "hum" of core and coil assemblies. An example of the results of this engineering effort is the recently announced "A" sound-rated 40-watt, rapid-start line. This popular family of General Electric ballasts was granted a G-E "A" sound rating as a result of *basic circuit design* that produced a smaller and quieter core and coil.

Materials are also an important sound-control factor. For example, the resilient asphaltic filling compound used in General Electric ballasts maintains excellent sound-absorbing characteristics over the entire life of the product. The new General Electric Bonus Line† ballasts, using this proved asphaltic filling compound, are designed to provide protection against objectionable ballast end-of-life leaking and smoking, without sacrificing any sound performance.

All this means that General Electric is truly concerned about ballast sound—and is investing heavily so you can stop being concerned with it yourself. Mail the coupon today for your General Electric Sound Rating Calculator, and start using it immediately. For more details, ask your local General Electric Ballast Sales Engineer, or write Section 403-02, General Electric Company, Schenectady 5, New York.

† Trade-mark of General Electric Company.

* Copyright 1956, General Electric Co.



GENERAL ELECTRIC SOUND RATING CALCULATOR

This ingenious device was designed so you can always predict *with 100% accuracy* whether a lighting installation will present noise problems. You can use it for any indoor lighting application from extra-quiet broadcast studios to noisy offices. On the easy-to-use circular slide rule you simply (1) dial in room "constant," (ability of room to absorb noise); (2) number of ballasts and their sound rating and (3) given ambient noise level for your application. Steps 1 and 3 are *immediately determined* from tables which are part of calculator.

PLEASE SEND ME THE FREE BALLAST SOUND RATING CALCULATOR

Mail coupon to: General Electric Co.,
Section D403-02, Schenectady 5, N. Y.

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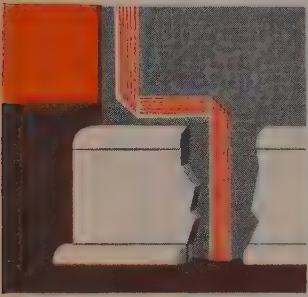
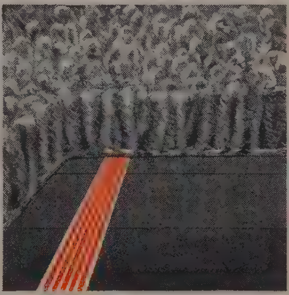
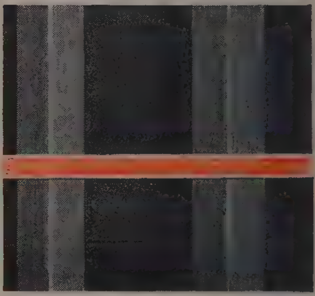


Installs behind surbases



Lies under floor coverings

Conceals easily behind wallpaper



Saves drilling in walls and wood

Use POLYSTRIP®... the new, easier way to make low-voltage interconnections

Users find POLYSTRIP a time, money, and headache-saver. The speed of installing this flat cable results in substantial savings. POLYSTRIP lies under floor coverings without causing bulges; slips between wallboard seams, behind moldings, through openings, thus eliminating drilling or cutting walls and woodwork. It fastens to finished walls, ceilings and baseboards with double-backed tape, doing away with conduit and plaster-cracking hardware. The many features of this new concept in cabling make POLYSTRIP equally valuable for new construction or renovation.

POLYSTRIP consists of uniformly spaced flat copper conductors laminated with transparent plastics into a very thin, flexible, flat cable. Already proved in industrial electronics, it is now applicable for hi-fi, paging, signalling and alarm systems, programming, wired remote TV control.

INSTALLER'S KIT SAVES 47%

Assortment #205 saves 47% over the separate prices of items it includes. Contains 75-foot rolls of both 3- and 5-conductor cable; 6 splicing and 2 wire lead type connectors* for both 3- and 5-conductor cable; 50-foot roll of double-backed adhesive tape and 1 Stripping Tool.

International Resistance Company, 414 North 13th Street, Philadelphia 8, Pa.

*POS-E-FLEX Connectors by The Thomas & Betts Co., Inc., Elizabeth 1, N.J.

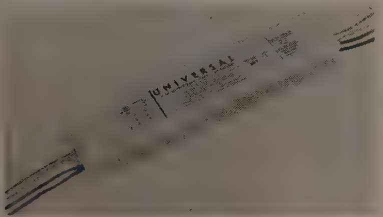
IRC

Leading supplier to manufacturers of electronic equipment

Timing Relay **(12)**

Class 9050 Type B and C timing relays are now available with a new 2-pole snap switch which doubles the number of contacts and mounts in the same space as a single-pole timer. Device is designed for applications where normally it would be necessary to install an extra timer or relay for control of additional circuits. Timing relay can also be furnished with one or two single-pole double-throw instantaneous snap switch interlocks, and is easily converted from on-delay to off-delay and vice versa. Timing is adjustable from 0.2 seconds to 3 minutes, and contacts are totally enclosed to avoid dust and dirt problems. Timers are available for both ac and dc operation and in a wide variety of enclosures for any application. Bulletin 9050 is available.

Square D Company, 4041 *N. Richards St., Milwaukee* 12, *Wis.*



Ballasts **(13)**

Fluorescent lamp ballasts for use in signs have been announced. They are available in a wide choice of rapid-start and slimline ballasts for use with a full range of lamp lengths in one to 4-lamp combinations. They are UL listed for non-weatherproof outdoor Type 1 and Type 2 use in signs. Each ballast is equipped with No. 14 gauge lead wires and enclosed in a white bonderized case.

Universal Manufacturing Corp., 29-51 *East Sixth St., Paterson* 4, *N. J.*

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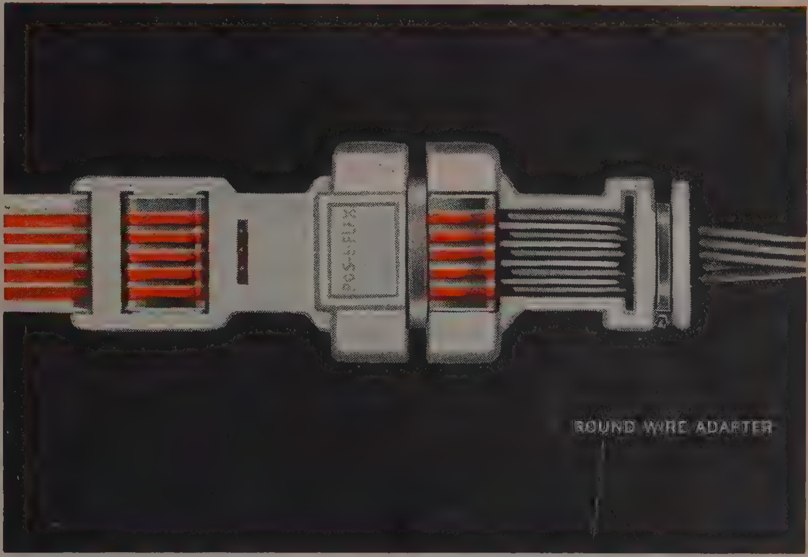
another new connector system from T & B



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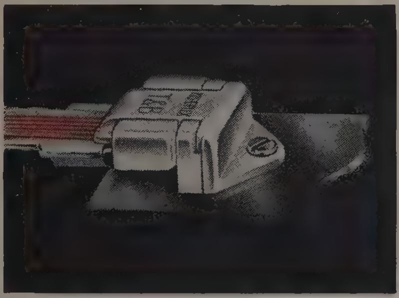

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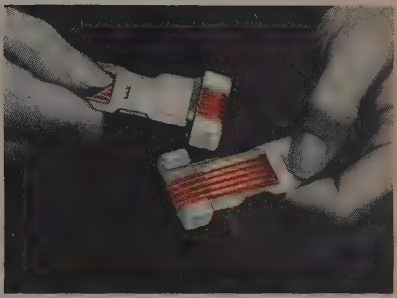

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Flat conductor cable joined by POS-E-FLEX solderless connectors can increase your dollar return . . . add new prestige values to every job.

Three basic connector types handle any flat cable connection, adapt to round wire—provide quick "snap-on" convenience.

See your T&B Distributor or write The Thomas & Betts Co., Inc., Elizabeth 1, N. J. In Canada: Thomas & Betts Ltd., Montreal

T&B ENGINEERED THOMAS & BETTS

New Honeywell

New Honeywell Square Secondary Clock

New Honeywell Round Secondary Clock

ClockMaster* System!

New styling! New works! New reliability!
. . . Same simplified installation
and famous Honeywell follow-through

Henry Dreyfuss, noted designer, styled the appearance. Honeywell designed and manufactured the clocks. Result: a new standard of clock styling, accuracy and dependability—ready and waiting for your next job.

Now two standard secondary clocks

To complement modern styling, Honeywell has introduced a square, ultra-modern secondary clock. You can combine it with the new Honeywell round secondary clock in systems to better match decorating requirements. Both clocks have bold, clear numerals that are easy to read at a glance.

Life tests show no failures in over six years

Both the new square and round secondary clocks have new rocker arm assemblies plus vital parts made of teflon. This cuts friction and wear. Increases accuracy, reliability and life. So much so, in fact, that accelerated life tests have shown no failures in over six years—and the tests are still running!

Foolproof system operation—even during power failures!

Programming of this newly styled master clock is so easy to change, one of your customer's employees can do it. Master time and programming units are positively linked so they can't get out of step. If power fails, the master clock switches automatically to a spring operation that runs it for 12 hours. Because each clock in the system is independently and automatically corrected hourly, all clocks are kept on time.

No installation headaches

Honeywell's unequaled service facilities assure prompt delivery exactly when you need it. Honeywell wiring diagrams are so accurate and easy to follow they're often called "best in the business." And you can always phone a nearby Honeywell Application Engineer if you should need help. Afterwards, Honeywell Maintenance men back you up 100% on every clock.

New Honeywell Master Clock
. . . so easy to change programming your customers' employees can do it.

Phone your nearest Honeywell office for complete information on Honeywell's new ClockMaster System. Or, if you prefer, write Honeywell, Dept. EC-9-164, Minneapolis 8, Minnesota. In Canada, write: Honeywell Controls, Limited, Toronto 17, Ontario.

Honeywell

First in Control

SINCE 1885

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TRISTAND VISE

on the job!

EASY TO FOLD
EASY TO CARRY
Extra Rigid in Use

Here's a solid workbench to speed all cutting, threading and reaming out on the job. No other vise offers as many work-saving features as this RIDGID No. 40-A Tristand Yoke Vise. • Big, rugged malleable vise base has 3 bending grooves, 6 tool slots, rear pipe rest and a ceiling brace screw for absolute rigidity if legs aren't bolted down. • Base overhangs front legs for clear tool swing. • Extra-large yoke latch opens for easy, fast insertion of long pipe lengths. • Replaceable LonGrip jaws give, slip-proof grip. • Handy tool tray locks legs open during use but folds for easy carrying with legs snap-chained together. RIDGID No. 450 Tristand Chain Vise with 1/8" to 5" capacity is also available.

Call your Distributor today. For your convenience, he maintains a complete stock of RIDGID Work-Saver Pipe Tools and parts.

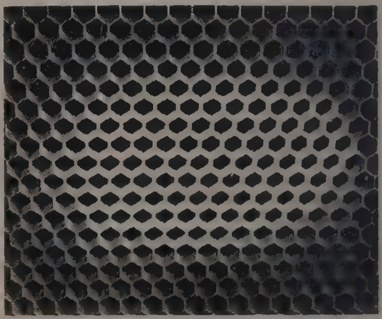
RIDGID®

The Ridge Tool Company, Elyria, Ohio, U.S.A.

Portable Load Center (14)

A lightweight, self-contained 120/240-volt, ac, portable utility distribution center of 50-amp capacity with overload and short-circuit protection has been announced. The 30-lb unit can be set up by one man at the construction site. Designed for use wherever construction sites or field test projects require temporary power, the load center contains six 15-amp, 120-volt outlets for power tools, and one 20-amp 2-pole, 240-volt outlet which can be used for welding, etc. Distribution centers can be cascaded or inter-connected by means of heavy-duty 4-wire receptacles located on each end of the main bus. Over-all size is 28 by 10 by 10 in.; height on legs is 36 in. Unit also can be provided in 100-amp capacity, and also with weatherproof construction.

Leonard Electric Manufacturing Co., 3907 Perkins Ave., Cleveland 14, Ohio



Ceiling Panel (15)

A new steel illuminated ceiling panel, called Metacel, has been announced. It is hexagonal in design and constructed of one continuous piece of steel. Metal thickness is 0.0083 tin mill black plate steel. Cell sizes are 3/8 in. hexagonal. Panel sizes are 2 by 4 ft, 2 by 3 ft, 2 by 2 ft, 2 by 1 ft, 1 by 3 ft and 1 by 1 ft. Recommended for commercial installations where maintenance is a factor.

John J. Fannon Products Co., Division of Hupp Corp., 3000 East Woodbridge, Detroit 7, Mich.

Insulation Putty (16)

A new electrical insulation putty known as Slipknot filler tape, which molds under finger pressure to make a completely homogeneous mass of insulation around connectors on cables and wires, has been announced. With a dielectric strength of 500 volts per mil, the tape is 125 mils (⅛ in.) thick. It is packed in 1½-in. wide rolls, 60 in. long, with parchment paper separator. Tape is black.

Plymouth Rubber Co., Inc., Canton, Mass.

Switchboard (17)

A new-design, free-standing metering switchboard is for electrical distribution systems in apartment and office buildings or any multiple-unit structures where separate metering is required. Each section of the new Uni-Power metering switchboard is a self-contained, free-standing unit on which meters may be mounted front and back. Each section measures 32 in. wide, 13½ in. deep and 77½ in. high. Main or primary sections comprise a main disconnect and up to 18 each of meter bases and distribution disconnects. When additional meters are required, distribution sections—each incorporating up to 24 meters—can be added. Main sections may be obtained with meters back and front, on one side only, or without meters. Distribution sections also are available with meters back and front, on one side, or with main lugs only. Main disconnects can be 2- or 3-pole fused switches or circuit breakers, rated from 225 to 1200 amps. Distribution disconnects are 15- through 100-amp circuit breakers.

I-T-E Circuit Breaker Co., Walker Div., P. O. Box 2384, Atlanta 18, Ga.

Just One RIDGID
3-WAY PIPE THREADER
Threads All 3 Popular Conduit Sizes!

No. 30-A threads ⅜″, ½″ and ¾″.
No. 31-A threads ½″, ¾″ and 1″.

Here's an extra-sturdy threader that's instantly ready to thread any of the three conduit sizes most used. Each die-set is locked in place . . . can't get lost. Yet dies are easy to reverse for close-to-wall threading. Centering guide keeps conduit straight for true-threads every time. Twin handles double leverage for easy thread cutting. Choice of long-wearing alloy or high-speed steel dies. Straight conduit dies also available.

Call your distributor today. For your convenience he maintains a complete stock of RIDGID Work-Saver Pipe Tools and parts.

RIDGID®
The Ridge Tool Company, Elyria, Ohio, U.S.A.

Luminaries (18)

New contemporary opal luminaires are designed for all outdoor or indoor locations. The white opal glass spreads evenly diffused light down and out in a wide pattern to illuminate porches, walks, entrances, carports, breezeways and other areas. The line is especially effective for architectural installations since all fixtures can be used with 100-, 150- or 200-watt lamps. Included in the complete line are 1- and 2-light units for wall, ceiling or custom pendant mounting.

Stonco Electric Products Company, 333 *Monroe Ave., Kenilworth, N. J.*

Receptacles (19)

A full line of E-Z wire receptacles with pressure-spring back wiring, built to specification grade, has been announced. Strip wires and push them into the E-Z wire pressure terminals for insured connections; to release, press down in slot with screwdriver. Receptacles take from No. 10 to No. 14 wire. Each terminal permits two connections for continuous wiring and all contacts are double-wipe "T" type. Mounting strap has wide plaster ears. Listed by UL. Duplex flush, T-slot duplex and parallel-ground duplex receptacles are rated 15-amp, 125-volt. The tandem-ground duplex receptacle is 250-volt.

Eagle Electric Mfg. Co., Inc., 2310 *Bridge Plaza South, Long Island City* 1, *N. Y.*

Switches (20)

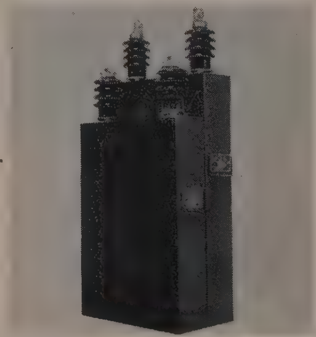
Designed primarily for air conditioning and heating installations, new maintained-contact ac switches can also be used for the alternate control of any two motors, or for any applications which require heavy-duty ac double-throw, center "off" switch controls. The "off" position is at center of handle throw with two circuits being energized at either end. A fiber insulating wrap-around is assembled under switch cover and can be folded down over terminals to protect wiring when switch is installed in small enclosures. Control is either by standard toggle or lock type handle, both fit openings in standard wall plates. Available in single or double pole, each with brown, ivory or lock type handle.

Pass & Seymour, Inc., Solvay Station, Syracuse 9, *N. Y.*

Scanner (21)

Type PE-1 photoelectric scanner system provides positive response when the light-beam is interrupted by objects as small as ¼-in. wide at counting rates up to 500 per minute. Depending on light source and photocell used, operating ranges can be up to 8 ft. Using a power-type photocell with high infrared sensitivity, and with a filter to minimize the effect of ambient visible light, this system operates a dc relay without need for amplifiers of any kind. The relay of this system is a plastic-cased, plug-in unit having two sets of single-pole single-throw load contacts, one normally open and the other normally closed. Contacts are rated 8 amps, 115 volts ac, non-inductive. Bulletin PE-1 is available.

Farmer Electric Products Co., Inc., 2300 *Washington St., Newton Lower Falls, Mass.*



Capacitors (22)

New 50-kvar capacitors featuring a reduction in weight from 91 to 70 lbs are available. Tank dimensions are 4 by 13½ by 20½ in. high. Units are rated 2.4 to 14.4 kv. Features are liquid circulation and improved pack design. The 100-kvar capacitors will retain the 15⅝-in. mounting dimensions.

Line Material Industries, McGraw-Edison Co., Milwaukee 1, *Wis.*

L-M's
LAWN-GLO LIGHT

Three styles, for driveways, terraces, walks, parks—wherever soft, efficient low-level lighting is desired. All-aluminum weatherproof design with utility outlet; simple; efficient; quality lighting up to 150 watts incandescent. Six decorator colors and brushed aluminum.

L-M's
POST-TOP
LUMINAIRE

—is an optically efficient, extremely adaptable unit for street lighting, parks, playgrounds, motels, pools, parking areas. Makes conversion extremely simple and economical. Choice of seven IES light patterns; six decorator colors or brushed aluminum; mercury, with ballast; or incandescent; photocontrol if desired.

STANDARD
MERCURY
OVALITE

luminaire, with built-in ballast; highly efficient for street and highway lighting; many convenience and safety features. Ask for bulletin.

WIDE RANGE OF
FLUORESCENT FIXTURES

In two and four light single, double units, for area, ramp, street, and underpass lighting. Also available with L-M's exclusive Peltier thermo-electric cooling for highest efficiency.

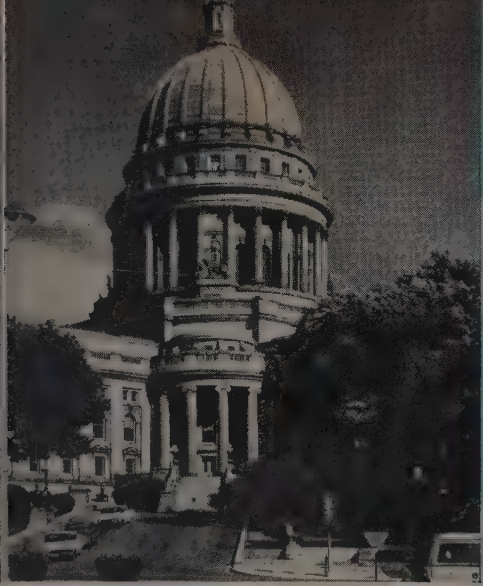
L-M
SUBURBANAIRE

Designed for neighborhood streets, suburban and rural areas. In incandescent or mercury, with open type borosilicate glass refractor in choice of light patterns.

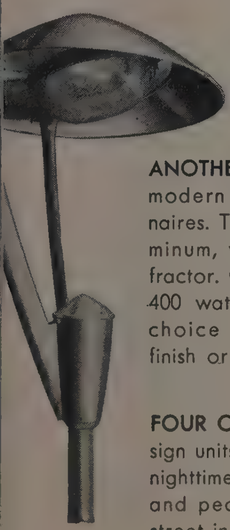
LINE MATERIAL
Industries
McGRAW-EDISON
COMPANY

525

Outdoor Lighting



DDED BEAUTY FOR LOCATIONS like this. The yled Mercury unit directs the light downwards nd eliminates glare. It illuminates 11,000 square feet to 3 footcandles. You need fewer and shorter poles, and less wiring, to get the desired level of light.



ANOTHER IN THE FAMILY of modern Styled Mercury luminaires. The entire line is all-aluminum, with Holophane® refractor. Choice of 1000, 700 or 400 watt ratings. Available in choice of brushed aluminum finish or five decorator colors.

●

FOUR OF THE LATEST design units provide excellent nighttime illumination for traffic and pedestrians on this busy street in a shopping section. ▶

-M Announces Another Graceful Design n The New Styled Mercury Light Family

ne Material's Styled Mercury luminaires are amily of high quality, high intensity lighting its. The latest addition to the Styled Mercury e is the upsweep design installed in the well- nted street shown above.

These are large, handsome luminaires, led for Line Material by a noted industrial igner. They will contribute daytime beauty and excellent nighttime lighting to any street, park, mall, public square, or parking area.

Line Material is a leading manufacturer of outdoor lighting designed specifically for the application. L-M also provides competent Lighting Application Service by experienced lighting engineers, available through Authorized L-M Distributors.

GET COMPLETE INFORMATION

Ask your Authorized L-M Distributor for bulletins, or mail the coupon.

50th YEAR 1911 — 1961

LINE MATERIAL® Industries
McGRAW-EDISON COMPANY
Outdoor Lighting

523

McGRAW EDISON

DISTRIBUTION TRANSFORMERS • RECLOSERS, SECTIONALIZERS AND OIL SWITCHES
FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING
LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

Line Material Industries, Milwaukee 1, Wisconsin

Please send me details on L-M Styled Mercury family of luminaires, and name of nearest distributor. ECM-91

Name____
Company_____________________________________
Address______________________________________
City_______________________State______________
Type of Area To Be Lighted_______________________

This is the little fella

that cut starter failures by 98%

See it? That condenser up there isn't paper (the usual thing), but *ceramic*. It's in every Sylvania starter and the difference it makes in performance will surprise you.

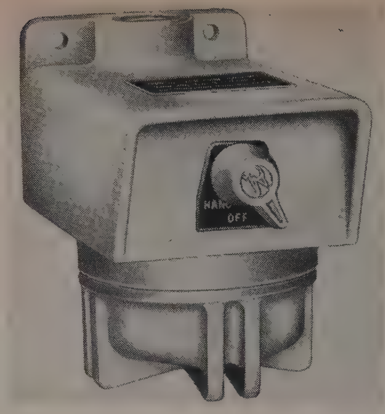
A two-year test in one manufacturing plant showed Sylvania fluorescent starters had only 1 failure out of 340 starters. Conventional starters with paper condensers had 51 failures out of 330 starters.

Paper can't stand up as well to heat, cold, moisture. Ceramic condensers do. Another reason why Sylvania alone can give you an exclusive Certified Performance Policy *guaranteeing:* "If at any time, in your opinion, any Sylvania Fluorescent Starter fails to give satisfactory service during the 12 months from date of purchase, it may be returned to the supplier for full refund of purchase price."

Yes, Sylvania lowers your TCL (Total Cost of Lighting). That means lower cost of lamp plus power plus MAINTENANCE. Try Sylvania next time you need starters!

SYLVANIA
Subsidiary of
GENERAL TELEPHONE & ELECTRONICS

Lighting Division, Sylvania Electric Products Inc.,
Dept. 15, 60 Boston St., Salem, Mass.
In Canada: Sylvania Electric (Canada) Ltd., Montreal.



Fitting **(23)**

Shielded controls and threaded construction throughout provide protection for wiring devices housed in these explosion-proof, dust-ignition-proof and raintight fittings. They are identified as EW Series Pylets. They are available with various standard wiring devices including tumbler switches, manual motor starters, pushbutton stations, selector switches and pilot lights. All operating controls have a threaded stainless steel shaft and are mounted on front face of body. Bodies are regularly tapped at top and bottom for ½- to 1-in. conduit. Back and both sides can also be tapped up to 1 in. when specified. Bulletin is available.

Pyle-National Company, 1334 *N. Kostner Ave., Chicago* 51, *Ill.*

Photoelectric Units **(24)**

"Modulite" protective units use a modulated (pulsating) light beam to detect the presence of a machine operator's hand or arm in a high-danger area. A special rotating disc modulates the light. The photoelectric receiver is "tuned" to the modulated-light frequency. In use, the interruption of the beam causes a signal that will stop a machine. A choice of projectors is offered with 1- or 2-in. light beams having ranges up to 20 and 80 ft, respectively.

Clark Controller Company, 1146 *East 152d St., Cleveland* 10, *Ohio*

Pipe Pusher **(25)**

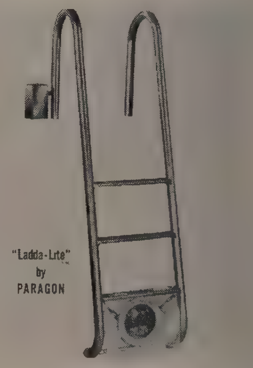
New heavy-duty Pow-r Mole was designed to push rod in any condition where pushing is possible and pull ½- to 3½-in. dia. copper, steel, plastic pipe or tubing underground. It attaches to most standard tractor- mounted hydraulic back hoes. Unit comes complete with full set of cribbing, 50-ft push rod, and pusher cap. Direction can be reversed by changing position of two drag springs with no need to turn pusher around. Unit has a 5-in. stroke and operates at a force of up to 35 tons.

Pow-r Devices, Inc., Clarence Center Road, Clarence Center, N. Y.

Cable **(26)**

Polyflex is standard non-metallic sheathed cable made with Walkersyn Type TW conductors and overall thermoplastic jacket. It is designed for open or concealed lighting and power circuits in reasonably dry locations. It is also used for interior wiring in homes, stores, shops, private garages, rural buildings, and for major appliance circuits. Listed by UL.

Walker Brothers, Conshohocken, Pa.



Light and Ladder **(27)**

A new underwater light and pool ladder combination, called Ladda-Lite, has been developed. The light is hung from the bottom step of the ladder. Ladda-Lites are available in the following styles: straight or sloping ladders in either chrome or stainless steel, 3-step and 4-step sizes; 500-watt Slim-Lite or Slim-Lite 12, a 12-volt, 300-watt light. Each package includes complete ladder with frames, steps, bolts and bumpers; complete light with electric cord and, for 12-volt lights, a special transformer. Also included are brackets to hang the lights, a plastic shield which is installed in front of light and chrome-plated brass conduit which goes between light and ladder frame. Also a weatherproof female receptacle with a 3-prong locking male plug, a chrome-plated shield for the receptacle and all necessary screws and nuts.

Paragon Swimming Pool Co., Inc., Pleasantville, N. Y.

Even if you ripped out half your fixtures...

you'd still get more light with Sylvania VHO Powertubes!

Or you could get 2½ *times more* light with the same number of fixtures you now have! Sylvania VHO (Very High Output) Powertubes are that much brighter than standard fluorescents. Yet they're only 1½″ in diameter. Light in weight. Easy to maintain (smooth *tubular* surface doesn't have nooks and crannies to catch dust which dims light).

And every one comes with this exclusive *money-back guarantee:* "If at any time a Sylvania Fluorescent Lamp fails in your opinion to provide better performance than any other brand fluorescent lamps, on the basis of uniformity of performance, uniformity of appearance, maintained brightness and life, it may be returned to the supplier for full refund of purchase price."

Only Sylvania gives you this Certified Performance Policy. It's your assurance of lowest TCL (Total Cost of Lighting), which means cost of lamps *plus* power *plus* maintenance. Get the pluses Sylvania offers. Call your representative now. Or write Lighting Division, Sylvania Electric Products Inc., Dept. 15 60 Boston St., Salem, Mass. In Canada: Sylvania Electric (Canada) Ltd., Montreal.

SYLVANIA

Subsidiary of **GENERAL TELEPHONE & ELECTRONICS**

SPECIFY McGILL®

PORTABLES FOR SAFETY, CONVENIENCE AND DURABILITY

THE QUALITY LINE

OVER 100 MODELS

NEW SAFETY YELLOW SERIES

GROUNDED

No. 5100 — SRG grounded portable with 15 amp., 125V outlet.

An extra margin of quality is built into the complete line of McGill industrial portable lamp guards for safe, dependable utility. Rugged, heavy duty construction and selected materials withstand the punishment of rough use.

More than 100 different types of McGill portable lamp guards have been developed to meet the particular requirements of a wide range of service conditions. Cages 50 to 200 watt. 660 watt, 250 volt sockets. Grounded, vapor-proof, double hook, reflector, concentrating end lens and many other optional features available. Most models also available with new "safety yellow" handles and cords.

Available from your Electrical Wholesaler

Write for McGill Electrical Specialties Catalog No. 84.

engineered electrical products

McGILL®

precision needle roller bearings

McGill Manufacturing Co., Inc., Electrical Div., 450 N. Campbell St., Valparaiso, Indiana

Junction Boxes (28)

A complete series of explosion-proof junction boxes with lens covers has been announced. The "GR" line includes copper-free, cast aluminum enclosures in eight sizes and are adaptable for housing meters, gauges, and instruments. All standard assemblies are supplied with two mounting lugs. Special brackets for mounting devices can also be furnished.

Killark Electric Manufacturing Co., 3940 *Easton Ave., St. Louis* 13, *Mo.*

Covers (29)

New spring door and locking covers for FS boxes and switch boxes, makes any duplex outlet—T Slot, parallel, 3-wire grounding, polarized or Turnlock—a weatherproof outlet. When one half of outlet is in use, the other half is closed securely. Covers close automatically when caps are removed. Any padlock can be used to lock both covers in place. As long as padlock is in place, center screw is inaccessible and cover cannot be removed.

Pass & Seymour, Inc., Solvay Station, Syracuse 9, *N. Y.*

Pipe Threader (30)

The "Amaz-O-Thread" die spinner is for on-the-spot pipe threading in sizes from ⅛ in. to 2 in. It is constructed of aluminum, weighing 18½ lb, and has ball bearings on all moving parts. This device will operate with either standard Ridgid No. 12-R dies or Nye No. N12-6 dies, and can be plugged in anywhere using 110 volts. Adapters available for 00-R and 111-R dies. Also for Ridgid No. 4-P geared dies for 2½-in. through 4-in. pipe.

"Amaz-O-Thread" Sales Co., P. O. Box 39752, *Los Angeles* 39, *Calif.*

Cable-Tray System (31)

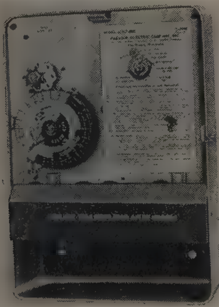
"Ladder-Way" is a new tray supporting system for insulated power cables, featuring a vertical plane elbow. Elbows are factory-assembled and shipped as straight, rather than curved pieces. Elbow side members are composed of flat links with rolled edges and are secured together by special Tinnerman fasteners. A fastener is inserted through the proper one of three notches in each link and through a single bolt hole in opposite end of adjoining link. Standard straight sections are 10 ft long with an inside depth of 3 in. Rungs have rounded edges, and rung spacings of 4, 8, 12 or 16 in. are available as well as various tray widths.

H. K. Porter Company, Inc., Delta-Star Electric Div., Chicago, Ill.

Lighting Unit (32)

An illuminated hand rail, called Lumi-Rail, is designed for lighting of stairways and passageways. Made of cast and extruded aluminum construction with acrylic shielding media, it is available in aluminum or bronze finishes. Unit can be installed indoors or outside on level or angling surfaces.

Ender-Monarch Corp., Garfield, N. J.



Time Control (33)

New 47007-SZ Series, 24-hour "Astro-Dial" time control for lighting applications. The control requires one setting and thereafter will turn lights "on" in relation to sunset and "off" at any pre-selected time with no further adjustment for seasonal changes. It is for use with incandescent, mercury-vapor or neon used for illuminating signs, billboards, show windows, parking lots and other lighting applications. Switching mechanism and capacity: 4-pole single throw, 4 NO isolated contacts, 20-amp T-rated, 120 or 208-240 volts, 690va pilot duty.

Paragon Electric Company, Inc., Two Rivers, Wis.

SO EASY TO HANDLE
WB DYNAPRENE PORTABLE CORD

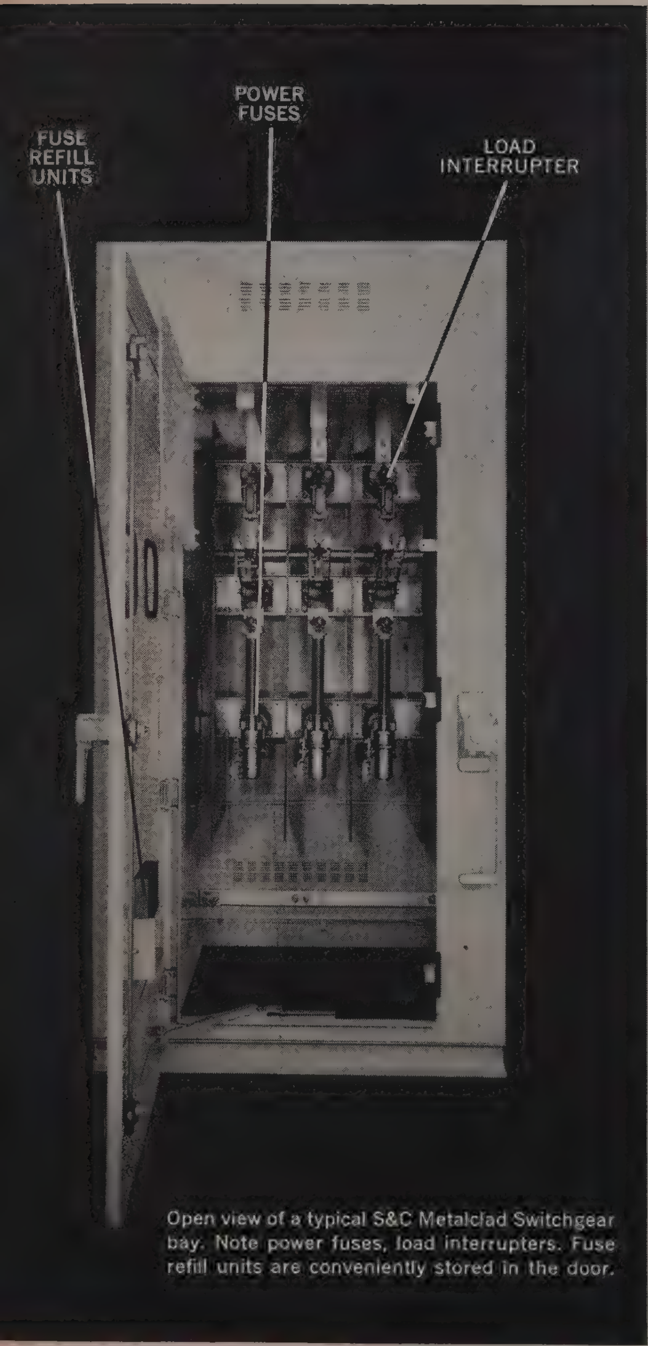
Smaller sizes are packed on spools in cartons . . . Larger sizes in coils, in knockout cartons . . . Easy to identify anywhere . . . Type, size and gage, clearly marked on jacket . . . Safe to recommend . . . Premium quality, long lasting, oil-resistant, neoprene jacket . . . U.L. approved.

Write for free Catalog PC-58 "Portable Cord and Cable"

WB WHITNEY BLAKE CO.

NEW HAVEN 14, CONNECTICUT / Telephone CHestnut 8-5515 / TWX: NH 84

Reclosing is for the birds



Open view of a typical S&C Metalclad Switchgear bay. Note power fuses, load interrupters. Fuse refill units are conveniently stored in the door.

So why buy this feature in your 2.4 thru 14.4-kv switchgear?

Reclosing is for the birds, squirrels, tree limbs, lightning, icing, windstorms, and kite strings that frequently cause non-persistent faults on open distribution lines of utility systems. Reclosing re-energizes the lines to restore service in a fraction of a minute.

But when faults occur on the enclosed power supply circuits of industrial plants, commercial and institutional buildings, you don't want to reclose on them. These faults—while extremely rare—are permanent. Someone has to locate the trouble and repair the equipment or cable—or at least isolate it—before the system can be re-energized. So why buy expensive circuit breaker type switchgear with its automatic reclosing feature?

S&C Metalclad Switchgear—employing fused load interrupters—gives the ideal protection for enclosed power supply circuits. Power fuses furnish the fault protection (load interrupters switch the load). After a fault occurs, you simply replace the inexpensive fuse refill unit (typically costing $13.50) while the fault is being located and corrected.

The economics all say, "Reclosing is for the birds." Why pay for a function you can't use?

Cut your high-voltage switchgear costs in half by specifying S&C Metalclad Switchgear for your 2.4 thru 14.4-kv switching centers, service entrances, substation primaries and secondaries. Get full-load switching to 1200 amperes and fault interrupting to 500,000 kva.

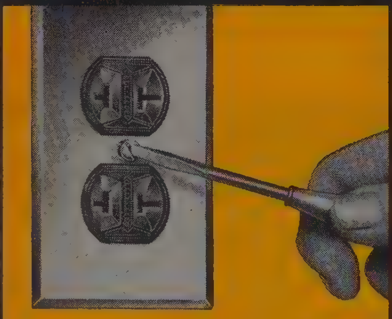
See the Yellow Pages (Electrical Equipment) for your nearest S&C sales engineer. Or write to:

S&C Metalclad Switchgear meets all NEC requirements for fault-closing, short-circuit interruption. Performance proved by high-power testing at KEMA laboratories.

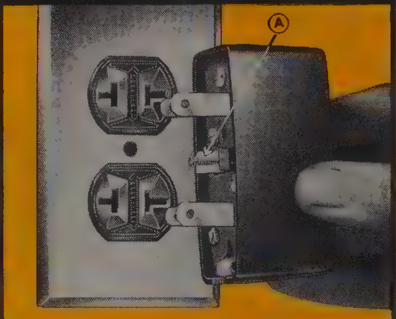
S&C ELECTRIC COMPANY
4433 Ravenswood Avenue • Chicago 40, Illinois
Specialists in High Voltage Circuit Interruption since 1911

The equipment is an S&C Metalclad Switchgear Assembly rated 13.8 kv, for a switching center.
The bird, a green-winged macaw, is an optional extra, obtainable at your local petshop.

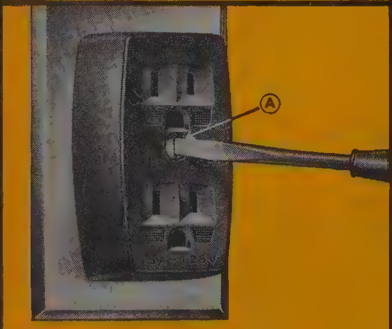
HUBBELL DUPLEX ADAPTER
15 A., 125 V.



Hubbell Duplex Adapter No. 5291 is easy to attach. Just remove screw holding metal or plastic plate to 2-wire receptacle. Leave plate in place.



Adapter plugs into 2-wire receptacle. Screw A will go through plate to grounded box. It is connected to both U-slots of adapter.



Tightening Screw A establishes adapter ground in a grounded system. If the system is ungrounded, connect adapter as shown at right.

When an existing system is not properly grounded, the adapter may be grounded by connecting a grounded wire to green hex Screw B.

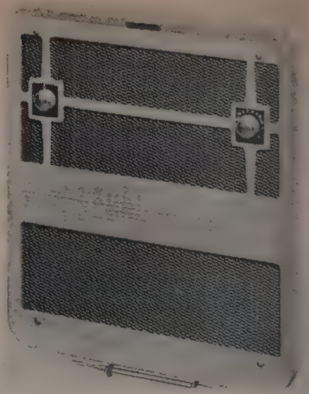
FAST TEMPORARY CONVERSION TO 3-WIRE GROUNDING SAFETY

This polarized, plug-in adapter converts 2-wire duplex receptacles used with grounded or ungrounded systems to temporary 3-wire grounding receptacles. Landlords find it a great convenience when tenants requiring 3-wire facilities cannot postpone occupancy until rewiring is completed.

To make a conversion, nothing in the existing system has to be removed except receptacle cover-plate screws, to make room for a captive screw in each adapter. This captive screw acts as a conductor from the two U-slots to the grounded system. For use with receptacles in ungrounded systems, there is a green binding screw to permit connection of an independent ground wire. Either way, the electrically independent blades and contacts continue existing split circuits.

The polarized adapter operates in any parallel or T-slot duplex receptacle with metal or plastic cover plates. Brown or ivorine bakelite, for 15 amperes, 125 volts. Size: 1.4″ from plate, 3.3″ high, 1.75″ wide.

HARVEY HUBBELL INCORPORATED
Bridgeport 2, Connecticut



Heating Equipment (34)

Totally enclosed stainless steel finned heating elements have been engineered into a new line of fan-forced wall Heetaires, Series H360 and H370. Designed for hard-to-heat rooms and buildings, units contain lifetime sealed-bearing motors. They have a heavy-duty hydraulic snap-action thermostat. Units feature safety controls that automatically break the circuit if air supply is obstructed in any way. Safety switches automatically reset. Heavy-duty wall Heetaires are available in 2000-, 3000- and 4000-watt units. Literature is available.

Markel Electric Products, Inc. and LaSalle Products, Inc., Buffalo, N. Y.

Current Transformer (35)

Current transformers, Type EMC, designed for high-current metering and relaying on low-voltage systems are offered in single or double ratios. The EMC is a 600-volt class window-type unit in current ratings of 800 to 4000 amps. It has four mounting holes that go through the transformer, one in each corner. It can be flush-mounted to a flat surface for either a vertical bus coming up through a platform or a horizontal bus extending through a wall or panel. Dual ratio units are offered in either 3- or 4-terminal arrangements.

Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa.

Scaffold (36)

A new scaffold, called Versa-Crane, is completely collapsible and may be loaded onto a pair of platform trucks for self-transporting. It is constructed of several independent units in such a way that each section may be used individually when desired. In addition, its platform scaffold may be raised or lowered with all equipment on it. Component sections are—two platform trucks with 4-position lock, ball-bearing casters; four independent ladders; two ladders which mount on truck and connect at top by a saddle to form a mobile ladder; an L-Beam fixed to saddles of two rolling ladders and equipped with a 1-ton chain block converts unit into a Gantry crane; a grip-strut safety platform mounts on ladders to complete VersaCrane. Unit adjusts from 32 in. above floor to a height of 12 ft 2 in.

W. B. McGuire Engineering Co., Ltd., P. O. Box 265, Champlain, N. Y.

Control (37)

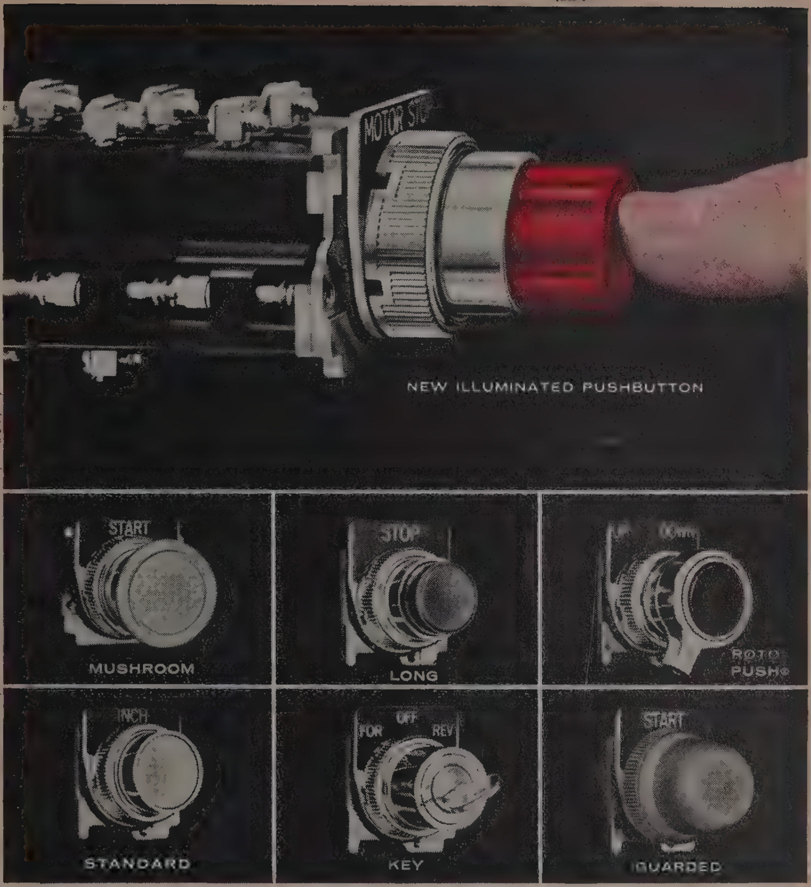
A new sequence control for electric heating. In the control, a switching circuit ties together a number of 5-kw load modules to form a single unit. The modules consist of a load switch and two transfer switches that are operated by thermal expansion rods. Electric circuit is such that the current in the thermostat remains at a low uniform value to insure stable anticipation regardless of the number of heat banks in operation. A switch for the blower is tied to the first module, making the blower first on and last off. Load switches control heat banks.

Controls Company of America, Heating and Air Conditioning Div., 2450 *North 32d St., Milwaukee* 45, *Wis.*

Lamps (38)

Two new lamps have been developed for underwater lighting. They are a 300-watt, 12-volt R40 and G30 operated from a suitable isolating transformer. The G30 is supplied with a medium screw base. The R40, complete with an internal reflector, is available with a medium screw or mogul screw base. Either lamp can be mounted in a watertight, recessed fixture in pool walls.

Radiant Lamp Corp., 300 *Jelliff Ave., Newark, N. J.*



New Cutler-Hammer oiltight pushbuttons give more circuit flexibility

Now you can make any pushbutton station you want from this new complete line of operators.

MORE THAN 30 DIFFERENT CIRCUIT ARRANGEMENTS

You can get these pushbuttons in one-hole or base mounting, six different colors. You can get more than thirty different circuit arrangements . . . hundreds of varieties of stations in standard arrangements of up to 25 elements. And you can get up to 8 circuits on one pushbutton. Flexible oil resistant diaphragm behind the button is designed to stay soft and pliable.

USE 40% LESS BEHIND-PANEL SPACE

This new Cutler-Hammer oiltight line gives you more control in less space because they use 40% less behind-the-panel space than the next smallest unit.

A colorful brochure, "MASTER DESIGN" will give you all the facts. Ask for Pub. LO-104-T241.

These new pushbuttons that give far greater circuit flexibility than any other make are the kind of improvements you can expect from Cutler-Hammer. Give your local sales office or distributor a call.

WHAT'S NEW? ASK...

CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. • Associates: Cutler-Hammer Canada, Ltd.; Cutler-Hammer Mexicana, S. A.

CONTROL

ABSOLUTELY
NO MAINTENANCE

You are looking at Stonco sealed-beam mercury vapor floodlights.

Hermetically sealed inside each lamp is a brilliant silvered reflector.

The reflector stays brilliant because nothing ever touches it. Not dust, dirt or grime. Not even smoke, soot or chemicals in hazardous areas.

You climb the pole only to change lamps. This could easily be once every five years. Probably longer.

(Conventional floodlight reflectors lose up to 15% efficiency if not cleaned every three months.)

What do you want from a mercury vapor floodlight? Higher lumen output? Longer lamp life? Lower power consumption?

Stonco sealed-beam mercury vapor gives you all of this, at far less cost. Plus . . .

Absolutely no maintenance.

STONCO lighting

Write for Catalog MV

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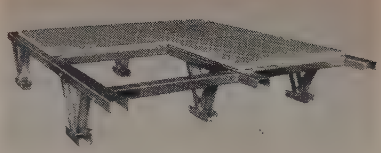
KENILWORTH, NEW JERSEY



Elevated Flooring (39)

Strato-Floor is a new type of elevated flooring particularly designed for use in electronic computer installations, or wherever extensive cabling and wiring systems require under-the-floor space and immediate accessibility. Modular 24 by 24 in. panels are made of plastic molded-around cross-laminated plywood. Sub-structure is an engineered grid support system. Steel stringers are bolted to a new kind of adjustable jack. Floor is designed to support a live load of 250 lb per sq ft, and a point load of 1000 lbs.

Strato-Floor, Inc., 795 East 152*nd St., Cleveland* 10, *Ohio*

Lamps (40)

Two designs are available in a new square fluorescent lamp. One has a waffle shape on the front and the other one shows the labyrinthine path of the current forming the discharge which results in the fluorescent light. Both types are 9 in. square so that they will fit directly into all existing 9-in. recessed incandescent fixtures, requiring only the addition of an instant-starting ballast. Their design life is 10,000 hours. Lamp is less than 2-in. thick.

Interlectric Div., El-Tronics, Inc., Warren, Pa.

Transformers (41)

Primary - service pad - mounted transformers (PSP) designed for residential underground distribution on grounded wye loop or dual-feed systems in primary voltages up to 15 kv are offered. Complete package of transformation protection and switching equipment is available in single-phase units, 10 to 167 kva. The PSP unit consists of three main components: a transformer compartment, a detachable high- and low-voltage terminal compartment, and a removable cover that provides complete isolation of all electrical connections and tank hardware. All three assemblies interlock.

Westinghouse Electric Corp., P. O. Box 2099, *Pittsburgh* 30, *Pa.*

Programmer (42)

An adjustable sequencing programmer employing a rotating-cam limit switch with its own adjustable-speed drive motor is available. Unit allows individual adjustment of 30 circuits through the use of micro-adjust split-lobe cams. By loosening a screw and rotating the cams relative to each other, a continuous range of an open and closed contact can be obtained from 352° down to approximately 8° of a revolution of the input shaft. The adjustable-speed drive motor facilitates changes in speed while cams are in motion. The adjustment dial enables unit to be adjusted before mounting and provides a reference if changes in programming are desired. Single-pole, double-throw, snap-action switches are used and have one normally opened and one normally closed contact which are electrically separate. Switches are rated at 5 amps, 440 volts, ac; 10 amps, 220 volts and 15 amps, 115 volts ac. Available in NEMA Type 1, 4, 7, 9 and 12 enclosures.

Gemco Electric Co., 25685 *West Eight Mile, Detroit* 40, *Mich.*

Cable (43)

A new service entrance cable with Vulkene insulation that doubles the life expectancy of the cable. Vulkene is a thermosetting, rubber-like insulation of chemically cross-linked polyethylene that combines the electrical and moisture-resistant properties of polyethylene with physical and heat-resistant properties. Vulkene-insulated singles require no braids or other coverings for protection against weather or sunlight at the termination. Listed by UL as Type SE Style U for installation in accordance with the NEC.

General Electric Company, Chemical and Metallurgical Div., Bridgeport 2, *Conn.*

Scaffold Accessory (43a)

An accessory is now available for supporting materials above the normal height of floor scaffolds. Known as Hold-A-Load, the support telescopes and locks into Baker scaffold end frames. The top sections can be adjusted to desired height by a thumb set screw in the lower locking sections. Two types of heads are available: a "T" head for lighting fixtures and flat equipment; and a "Y" head for conduit, piping, duct work, etc.

Baker-Roos, Inc., 602 *W. McCarty St., Indianapolis* 6, *Ind.*

Product Briefs

(44) General Electric Co., Low Voltage Switchgear Dept., Philadelphia, Pa., has announced a new line of silicon dc **power supplies** available in ratings from 0.75 to 75 kw. . . . (45) New distribution-class, valve-type **lightning arresters,** designated Type E5 direct connected and T5 externally gapped, in standard voltage ratings of 1 through 20 kv, are now available from Line Material Industries, McGraw-Edison Co., Milwaukee, Wis.

(46) Newman Electric Motors, Inc., Newark, N. J., has expanded its line of DK Series single-phase **motors** with the addition of a 5 hp, 1800-rpm unit. . . . (47) A higher minimum flash point for "Diala" oil AX, an electrical **insulating oil** for large transformers and high output electrical equipment, has been announced by Shell Oil Co., New York, N. Y.

(48) Anaconda Wire and Cable Co., New York, N. Y., has introduced a new ATRC **cable** especially designed for use in telemetering, automatic relays, communications circuits and supervisory control systems. . . . (49) Arrow-Hart & Hegeman Electric Co., Hartford, Conn., announces that many **switches,** receptacle and wall plates in their line of wiring devices are now available in neutral gray plastic.

(50) Sylvania Electric Products Inc., New York, N. Y., announced the development of a **fluorescent lamp** designed to improve certain growth aspects of plants through specific spectral energy distribution. . . . (51) A UL listed, "SCR" **dimmer** available in 3-, 4-, 5-, 6-, 10- and 12-kw capacities has been announced by Kliegl Bros., New York, N. Y.

(52) Anaconda Wire and Cable Co., Hastings-on-Hudson, N. Y., has been granted a patent on their **end-closure** for cable-enclosing pipes. . . . (53) New **connectors** for back-to-back mounting of electrical boxes has been introduced by Quicktime Electrical Products, Chicago, Ill.

(54) Emerson Electric Co., St. Louis, Mo., has announced their new Emerson-Imperial **lighting fixture** line designated "Trendlighting." . . . (55) A new "Unifilm 100" power **capacitor** weighing only 132 lb and occupying 2050 cu in., has

Rules and Regulations Relating to the Use of Submersible Lighting for Swimming Pools, Reflector Pools and Display Fountains.

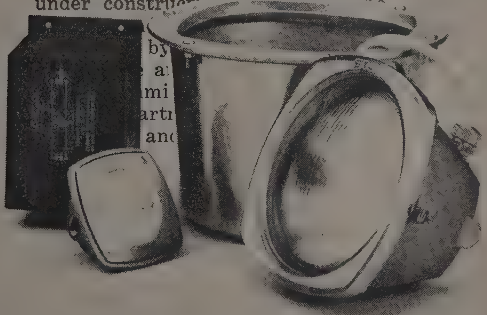
Bulletin No. 17

17.1 General—Effective as of this date, the use of 120-volt lamps when assembled in submersible lighting units, for the illumination of swimming pools, reflector pools or display fountains, whether they are intended for side wall or pedestal mounting, is hereby prohibited.

17.2 Voltage—The permissible voltage that may be applied to lamps used for such application shall not exceed 12 volts.

17.3 Transformers—a. Step-down transformers used in conjunction with such lighting units shall be of the two-winding, isolating type and having a grounded metallic shield between the primary and secondary windings to prevent accidental contact between windings under fault conditions. b. Transformers shall be located remotely from the lighting units which they supply, and overcurrent protection shall be provided in both primary and secondary windings.

17.4 Swimming pools, reflector pools, or display fountains presently under constru



LIFESAVER

Underwater lighting is serious business.

Deadly serious.

Cutting corners can cost lives.

Precisely why the Stonco line is solid cast bronze. Porosity-tested. With a special low voltage transformer for safety plus.

(We've tamed the high voltage. Isolated it with a grounded shield that stops cross-over from primary to secondary. Harnessed it with a fuse factory-sealed to guard against do-it-yourself electricians.)

Even the deck box is gasketed watertight fore and aft. Keeps wiring bone dry. From surface slop, seeping water, or pool overflow caused by flash floods.

No wonder Stonco submarine lighting meets all the safety codes.

Incidentally, even our fountain lights are available low voltage.

Fish have to live too.

STONCO *lighting*

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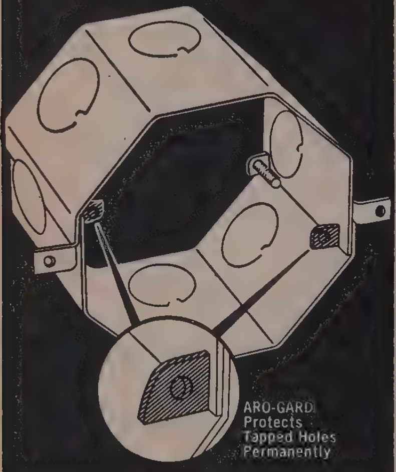
Another ARROW CONDUIT
EXCLUSIVE!

ARO-GARD* PROTECTIVE COATING TRADE MARK

KEEPS CONCRETE OUT OF TAPPED HOLES IN CONCRETE RINGS


ARO-GARD Protects Tapped Holes Permanently

* Pat. Pending

Now, one more of your big costly installation problems is eliminated... no more wasted time in cleaning concrete out of tapped holes! "ARO-GARD", Arrow Conduit's new protective plastic compound, covers tapped holes during manufacturing process. "ARO-GARD" is hard enough to keep concrete out of tapped holes —yet soft enough to allow screw to penetrate protective film with ease.

"ARO-GARD" is easily identified by green color (see shaded area in illus.). Now available on all Arrow Conduit Concrete Rings, at NO ADDITIONAL COST TO YOU.

Write for samples and data of "ARO-GARD" application process.

New Products from Arrow Conduit help you keep pace with modern wiring needs.

OUTLET BOXES • GANG BOXES • COVERS • BOX SUPPORTS
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Sales Representatives & *Warehouse Stocks *ATLANTA, GA. • BALTIMORE, MD. • *BIRMINGHAM, ALA • *CHICAGO, ILL. • *CINCINNATI 37, OHIO • DALLAS, TEXAS • *DETROIT 2, MICH • GREENSBORO, N.C • *LOS ANGELES, CALIF • *MIAMI, FLORIDA • *NEW ORLEANS, LA. • NEW YORK CITY, N.Y. • NEWTON CENTRE, MASS. • *PHILA., PA. • RICHMOND, VA. • ROCHESTER, N.Y. • SEATTLE, WASH • ST. LOUIS, MO

been introduced by General Electric's Capacitor Dept., Hudson Falls, N. Y.

(56) Kaiser Aluminum & Chemical Corp., Oakland, Calif., has announced an improved aluminum electrical conduit, called "Kingfisher" rigid aluminum **conduit,** featuring an interior coating with a high silicone content. . . . (57) Four new designs of butyl-molded high current instrument **transformers** for 5000, 8700 and 15,000-volt service in ratings from 1200 to 4000 amps are now available from General Electric Co., Schenectady, N.Y.

(58) Wesco Furnace Div., Northwest Foundry & Furnace Co., Portland, Ore., has announced an electric duct **furnace** installed in the air duct in sizes 10, 15 and 20 kw producing 34,150 to 68,330 Btu. . . . (59) A line of 830-volt outdoor **capacitors** for electrified pumping rated from 2 to 6 kvar is available from Westinghouse Electric Corp., Pittsburgh, Pa.

(60) Universal Manufacturing Corp., Paterson, N.J., has announced that all Universal "service guaranteed" **ballasts** CBM certified by ETL for use with 40-watt rapid start lamps are now "A" sound rated. . . . (61) New **pushbutton** series in one, two, four and eight button sizes in the new blue-biege color are now available from Suttle Equipment Corp., Chicago, Ill.

(62) Plymouth Rubber Co., Inc., Canton, Mass., has added two smaller sizes to their "Flip-N-Cut" instant **dispenser-cutter** for slip-knot plastic electrical tape—a 44-ft and a 30-ft roll. . . . (63) The all-new Ettco-Flex non-metallic sheathed **cable** (Type NM) now plastic jacketed is available from Ettco Wire & Cable Corp., Brooklyn, N.Y.

(64) Sierra Electric Corp., Gardena, Calif., has added a line of narrow **plates** in seven widths from 1⅜-in. to 2½-in. . . . (65) A new 100-hp **dual-belt unit** has been added to complete line of Vari-drives now ranging from ¼ to 100 hp, with units of 50, 60 and 75 hp in the dual-belt design by U.S. Electrical Motors, Inc., Los Angeles, Calif.

(66) Sylvania Electric Products, Inc., New York, N.Y., is now manufacturing an airport **lighting fixture** of heavy-impact design.

Catalogs & Bulletins

(67) LIGHTING. "Steel Lighting Standards," 28 pages, contains photos and specifications on Weld-Rite standards for lighting freeways, streets, parking lots, etc.; and "Flood Lighting Poles," 12 pages, covers poles for stadiums, playgrounds, driving ranges and security areas. Weld-Rite Co.

(68) INFRARED EQUIPMENT. Brochure describes new techniques, using fluid cooling, now making possible very compact quartz lamp ovens and furnaces with extremely high heat-transfer rates. Fostoria Corp.

(69) CIRCUIT BREAKERS. A handy selector disc permits quick determination of physical and electrical characteristics of six basic types of breakers. Westinghouse Electric Corp., Standard Control Div.

(70) CEILING PANELS. 4-page brochure describes the design of luminous ceilings with metalclad steel ceiling panels. Fannon Products Div., Hupp Corp.

(71) FOOT SWITCHES. Bulletin GEA-7086A, 4-page revision, includes latest information about complete line of heavy cast-iron foot switches. General Electric Co.

(72) MERCURY-VAPOR LAMPS. "Why Lifeguard Mercury Lamps?" contains information about life and maintenance, lamp construction and a chart on lumen output. Westinghouse Electric Corp., Lamp Div.

(73) CONTACTORS AND STARTERS. Bulletin GEA-7326, 8 pages, describes NEMA Sizes 3 and 4 magnetic contactors and starters added to 100-line of motor controls. General Electric Co.

(74) BATTERY CHARGERS. Bulletin 6202.1 describes performance features and construction details of expanded line of lead-acid battery chargers. Lincoln Electric Co.

(75) CONDUIT. "Color-coded" Sherarduct conduit with MVC-1 coating is described in 4-page Bulletin No. 713. H. K. Porter Co., Inc., National Electric Div.

(76) LIMIT SWITCHES. Publication GEA-7312.1, 2-page supplement to Limit Switch Bulletin GEA-7312, includes information on new CR-9440 extended arm J1 and K1 limit switches. General Electric Co.

NO BOLTS, NO SCREWS, NO DRILLING

with **NEW** Permacel Junction Box Mount epoxy adhesive
. . . the fast, easy way to attach junction boxes to any surface.

* Guaranteed for a period of one year from date of purchase not to harden in the cup until mixed or until divider section is removed.

PERMACEL®

NEW BRUNSWICK, NEW JERSEY • TAPES • ELECTRICAL INSULATING MATERIALS • ADHESIVES

Pipe or Conduit Hangers

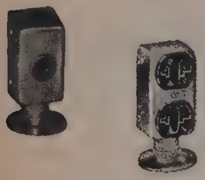
Most complete line with addition of 2 new sizes to oldest established standards in the industry.

The saddle or pipe support can be turned 360°, permitting pipe to run parallel or at right angle.

Excellent for confined areas—No drilling—no use of straps.

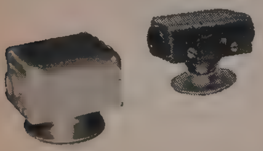
Made of highest grade malleable iron, with case hardened set screw—all cadmium plated. For Aluminum, write for details.

For hanging 1/2" thru 2 1/2" pipe or conduit to steel beams 3/8" thick.



Short Stem TELEPHONE *and* DUPLEX NOZZLES

These modern, flanged, short stem duplex telephone and receptacle nozzles can be used with all types of "Latrobe" boxes and come in satin brushed brass or anodized aluminum. Standards fit 1/2" opening. 3/4" stems are available, also grounded type receptacles.



BRASS *and* ALUMINUM

Sales Representatives in all principal Cities

Sold only thru wholesalers

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MANUFACTURING COMPANY
1209-1215 JEFFERSON ST.
LATROBE, PENNSYLVANIA

(77) POWER SUPPLIES. Bulletin CV-235-A covers constant voltage dc power supplies. Sola Electric Co.

(78) PANEL METERS. Bulletin GEZ-3352 describes new rectifier-type ammeters and voltmeters. General Electric Co.

(79) LIGHTING. 4-page lighting report entitled "Indoor Sports Lighting for Educational Institutions" includes 12 photographs showing both mercury-vapor and incandescent fixtures in indoor gymnasium applications. Holophane Co., Inc.

(80) MAGNETIC DRIVES. Bulletin 3650 describes magnetic adjustable speed drives available in ratings from 50 through 2500 hp. Louis Allis Co.

(81) FLOODLIGHTS. Bulletin GF860 describes new multi-purpose floodlight "Generalflood" added to their line of new Intenso floodlights. Appleton Electric Co.

(82) TERMINALS. New catalog enables user to select proper terminal or splice by computing circular mil area of wire. AMP Inc.

(83) HEAT CONTROL catalog gives detailed description and illustrations of complete line of thermostats for the control of electric heating. Mears Controls Inc.

(84) PHOTOELECTRIC CONTROL. Bulletin GEA-7230 describes new simplified photoelectric control designed for any lighting application where extended time delay is not desired. General Electric Co.

(85) MAGNET WIRE. Technical brochure covers Class B cement coated epoxy magnet wire. Anaconda Wire and Cable Co.

(86) PORTABLE ELECTRICAL TESTERS. New 8-page catalog lists a full line of portable units, with complete data on models, accuracies, ranges, features and prices. Daystrom, Inc., Weston Instruments Div.

(87) MOTORS. Bulletin 107 features complete line of Shell-Type motors available in open, enclosed or liquid-cooled ratings ranging from ½ to 150 hp. Louis Allis Co.

(88) MOTORS. 6-page Bulletin L-3313A describes full line of ac general purpose 56-frame motors for driving such machines as compressors, pumps, high inertia fans and blowers, refrigerators, air conditioners and machine tools. Kingston-Conley, Inc.

(89) LIGHTING. Seven bulletins, presented in tabular form, describe and illustrate line of commercial incandescent lighting in new 1961 lighting catalog. Art Metal Lighting Div., Wakefield Corp.

(90) INSULATION. Gold Bond Mineral Wool Insulation Consumer Booklet 2149 simplifies insulation selection and shows homeowners "where" and "how" to insulate. National Gypsum Co.

(91) RADIANT HEAT. Electric infrared radiant heat is explained in 4-page brochure containing application illustration—both indoors and out. Fostoria Corp.

(92) SOLDERING. Catalog 111 contains a complete listing of industrial electric soldering irons—a total of 80 models in seven distinct types; 20 to 700 watts; ⅛-in. to 1¾-in. tips. Hexacon Electric Co.

(93) LIGHTING. 4-page brochure describes the features of the new Park Square line of incandescent lighting fixtures and illustrates how the basic housings can be used to accept any one of several combinations of new face frames and shieldings. Litecraft Mfg. Corp.

(94) CONDUCTORS. Core wires, cable reels and conductor lengths are described in new revision of "Aluminum Electrical Conductors, Stranded-Bare." Rome Cable Div., Aluminum Co. of America.

(95) ELECTRIC HEATING. New 1961 catalog details complete line of portable heaters including new portable automatic baseboard Heetaires. Markel Electric Products, Inc. and LaSalle Products, Inc.

(96) INSULATION. Plastic wall chart simplifies the choice of proper insulation to meet the new "R" factor standards, shows the unique color-coding system which identifies Gold Bond mineral wool insulation thicknesses, and specifies the Gold Bond products which best meet the "R" factor requirements of the new standards. National Gypsum Co.

(97) BORING TOOL. 4-page Bulletin 359 describes Extend-A-Bit drill for boring holes through successive joists or studs in new or finished ceilings and walls. Ability Electric & Mfg. Co.

(98) HIGHWAY SIGN LIGHTING. Booklet B-8253, 8 pages, shows how to use fluorescent equipment to light any type of highway sign. Westinghouse Electric Corp., Lighting Div.

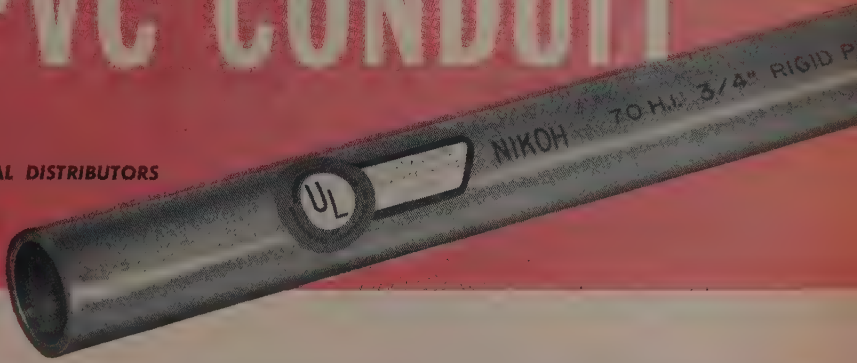
- ★ **Hot-dip galvanized rigid steel conduit**
- ★ **Electrical metallic tubing**
- ★ **Rigid aluminum conduit**

AND NOW . . .

ONE MORE

FROM NIKOH . . .

RIGID PVC CONDUIT



SOLD THROUGH RECOGNIZED ELECTRICAL DISTRIBUTORS

For safe, permanent installations . . . underground or encasement in concrete

- Resists corrosive vapors, liquids and electrolytic action
- Non-sparking . . . will not support combustion
- Impact-resistant
- Complete range of sizes
- Extra smooth inside walls
- Lightweight . . . easy to handle and install
- Listed under Reexamination Service of Underwriters' Laboratories

These are just a few of the many advantages of Nikoh Rigid PVC Conduit. Send for full details.

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"IT'S BETTER TO PLAN WITH NIKOH"

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THE RACO PACKAGE
A complete line of
Money-saving boxes and fittings

You can rely on Raco's top quality and complete line of fittings and boxes to help you do any wiring job better. Work with Raco fittings and boxes and you will see! Profit from the many user-benefits that make your job easier.

For your fitting and box needs, check Raco first. The Raco Package saves you time on-the-job.

Time Saving Features

RACO

ALL-STEEL EQUIPMENT INC., Aurora, Illinois

FITTINGS

BOXES

Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installations, maintenance and repairs. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

T-Connected Transformers

QUESTION X39—The consensus of opinion at our plant is that economics dictate in the design of T-connected transformers for 3-phase to 3-phase power in capacities of 15 kva and less.

I would appreciate a discussion on the subject of economics of design for 3-phase transformation on T-connected vs. 3-phase transformers.—J.A.M.

ANSWER TO X39—With the advent of the 480Y/277-volt system for large commercial and industrial buildings, 3-phase, T-to-T connections have been widely used to provide reduced voltages for small blocks of power up to 15 kva. As you state, economics is the main consideration for selecting the T-connected transformers in the smaller ratings.

The T-T connection requires only two single-phase transformers. One of the units is called the main transformer, which has a 50% voltage tap to which the teaser transformer is connected. With the T-T connection, the bank capacity is the same as for two transformers connected open delta (57.7% of the normal 3-phase bank capacity). However, T-connected transformers have a somewhat higher efficiency than open-delta-connected transformers because the teaser transformer, if identical units are used, operates at reduced flux density; and therefore will have lower iron loss.

When considering large numbers of small 3-phase units (3 kva through 15 kva) for a given installation, substantial savings will be effected by selecting T-connected units over other types where voltages are 600 or less. And finally, economics is an important factor in sound engineering practices; so why pay more for 3-phase units that contain an extra transformer when the performance and service of the T-connected units have proven to be entirely satisfactory in the ratings previously stated.—J.H.W.

ANSWER TO X39—You have observed the situation correctly in the first sentence of your question. The simple truth is that T-connected transformers, in ratings up to 15 kva, 600 volts and below, are the least expensive units for reducing primary voltages of 480 or 600 to 208Y/120. I might add that the use of T-connected transformer units in the stated ratings has been considered a standard practice for the last few years.—O.A.K.

Circuit-Breaker IC Ratings

QUESTION Y39—We have a 100-amp, 3-phase, 208/120-volt lighting panel with a 50-amp, 3-pole, "EH" frame, main breaker and nine 20-amp, 1-pole, "EQ-B" frame branch circuit breakers. All branch-circuit wire is No. 12 TW. The current available with a short circuit at the panel is 14,000 amps asymmetrical; a fault on a branch circuit 5 ft or more from the panel would have 5,000 amps or less available. Should "EH" frame breakers have been used for the branch circuits to protect against a fault in the first 5 ft, or will the main breaker handle this?—A.G.C.

ANSWER TO Y39—To place this discussion in the proper perspective, we must first realize that the interrupting-capacity ratings for fuses and circuit breakers must be based on the short-circuit current available at the point of application—not 5 ft away—but at the closest possible point that a fault could occur. All manufacturers of protective devices advise this, and it is an important factor in sound engineering practices.

The only time an overcurrent device can be installed at a point in a distribution system exceeding its IC rating is when it is "backed up" by devices having appropriate current-limiting features and coordinated ratings. And where this procedure is contemplated for circuit breakers, one should consult the circuit-breaker manufacturer as to the minimum and maximum ratings of CL fuses recommended for "back-up" protection.

In the installation you have described, you are attempting to place circuit breakers of a smaller IC rating in series with a main breaker with a higher IC rating, expecting that the main breaker will protect the smaller breakers in the event a short circuit occurs, which exceeds the IC rating of the smaller CBs. It will not work because the 50-amp CB does not have current-limiting features that would limit the short-circuit current to a magnitude low enough to protect the 20-amp CBs. Type EQ-B breakers have an interrupting rating (NEMA) of 5,000 asymmetrical rms amps. And taking the data from one manufacturer, the interrupting rating for the EH frame CB is 20,000 asymmetrical rms amps when applied at 240 volts. Another manufacturer rates his EH frame breakers at 10,000 asymmetrical rms amps, so let's hope that your particular EH frame CB will handle the 14,000-amp short circuit you have computed. Assuming that it will, the EH frame breaker should have been used for the 20-amp branch circuits, as it is apparent from your description that a short at the point of application of the 20-amp CBs will exceed 5000 amps (the maximum interrupting rating of the EQ-B breaker). The only other alternate would be the use of the coordinated CL fuses ahead of the 50-amp EH breaker of a size to protect the 20-amp EQ-B breakers. However, consult the CB manufacturer first.

The discussion up to now has related only to the aspects of minimum safety. In the future, why not consider the selective coordination plan, which takes into consideration sound engineering as well as safety. This plan of overcurrent protection provides for clearing faults by the device next back from the fault. For example, a fault on a branch circuit will be cleared by the branch-circuit overcurrent device; and the subfeeder, feeder and main overcurrent devices in series with the branch-circuit device back toward the service entrance will not operate. On a subfeeder fault, only the faulted part of the system will be taken out of service—which minimizes the extent of the outage. On the other hand, a branch-circuit fault, which opens the protective device for the subfeeder or feeder supplying the branch-circuit devices, causes loss of power to *all* branch circuits connected to the subfeeder or feeder.

Sell the electrical system General Electric

New sales features help you

Women "light up" when they see this G-E Master Selector Switch. It lets them dial 12 lights ON or OFF all over the house . . . from the bedroom. They know it will save them steps, every day of the year — and help them feel safer, late at night, too. Attractive pilot-lighted directory shows exactly which lights are ON.

Multi-point control costs less with G-E low-voltage switches and wiring. Put switches at every doorway.

Conveniences such as extra control points for outside lights — are more practical and economical to offer.

There's powerful "magic" in G-E master switches. They light up whole property at touch of a finger!

Added safety important — Switches carry just 24 volts — relays separate them from 120-volt circuits.

that helps sell homes . . . Remote-Control Wiring

get profitable new business

New switches, new book, new movie . . . to help you . . . Handsome new G-E Remote-Control Wall Switches come in standard pushbutton, locking and trigger styles — each in non-lighted, locator-lighted and pilot-lighted types. New "plug-in" relay centers give you quiet, simplified installations.

A new Technician's Manual and movie help show you how to install this modern, low-voltage system. You learn simple techniques that will pay off for years!

Looking for a new idea that will set you apart from your competition?

Install the newest in electrical systems — G-E Remote-Control Wiring. It offers extra eye appeal, convenience, comfort and safety that other systems can't match.

Builders like G-E Remote Control because it is a low-cost, house-selling feature — easy to demonstrate — effective in persuading customers to buy.

They like the extra 3-way and 4-way switching they can offer — the dramatic master switching — at surprisingly economical cost.

Get the jump on competition. Offer the latest and best wiring in your community — G-E Remote-Control Wiring. It bears the name your customers recognize as the leader!

MEDALLION HOME
LIVE BETTER ELECTRICALLY

Get started now! Mail coupon for free Technician's Manual
— or obtain one from your local G-E Distributor.

Progress Is Our Most Important Product

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General Electric Company
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Gentlemen: Please send me a free copy of your Remote-Control Wiring **Technician's Manual** for Residential Construction.

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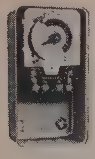
COMPANY ....
ADDRESS ....
CITY .... STATE ....

I would also like to see your new Remote-Control Wiring movie, "Pathways of Living" when shown in my area. ☐

24-Hour Control
Bulletin 6119

Skip-A-Day Control
Bulletin 6119

Astro-Dial Control
Bulletin 6022


Outdoor Control
Bulletin 6119

7-Day Control
Bulletin 5976

4-Pole Control
(24-hour dial)
Bulletin 6023

Miniature Control Mounting
Bulletin 5901

15-Minute Control
Bulletin 5915

Interval Control
Bulletin 6009

PUZZLED about time controls?

PAYS to know these **PARAGON** automatic time controls . . . they solve most any problem

How many of these precision-built Paragon Time Controls do you know? These are only a few of a complete line offered by Paragon . . . hundreds of models are available for practically every application in farm, home and industry. Today, Paragon is recognized throughout the world as a leader in the time control field, because all of its engineering and manufacturing skill is devoted exclusively to one product —TIME CONTROLS.

It will pay you to know more about Paragon. For more information on Paragon's complete line . . . location of its 88 Service Centers . . . contact your authorized Paragon Distributor. He carries a full line in stock, and is highly qualified to offer technical assistance on any application. There is no obligation.

AmF

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Automatic Reset Control
Bulletin 6002

Percentage Control
Bulletin 6003

Cycle Repeater Control
Bulletin 6008

Flush Mounted Control
Bulletin 6133

All-purpose Control
Bulletin 6133

Air Conditioner Control
Bulletin 6133

Each protective device in the selective coordination plan is rated for short-circuit duty at its point of application. The coordination is achieved by studying the overload-current curve vs the time required for operation of each device. Following this, selection of devices is made so that the device nearest the load will operate faster than all the devices behind it; and each of the other devices in sequence back to the service entrance will operate faster than any of the devices behind it. The main overcurrent device (the one farthest from the load) must have the longest time delay on branch-circuit faults.—J.K.L.

Synchronous Motor

QUESTION Z39—I have, in several cases, tried to pick up wattless current with 1.0 pf synchronous motors by increasing the dc excitation. It just doesn't work. Why?

I have done this with 80% pf machines (motors and generators) and it does work.

Why, if we have an 80% full load on a 1.0 pf motor, will it not carry the balance of its capacity in kvar the same as one rated at 80% pf will do when carrying 100% of its rated hp or kw load?

I have tried this on 1.0 pf motors working at only 20% to 30% of their rating; even then I was unable to get an increase in motor amps with an increase in field excitation.—A.A.N.

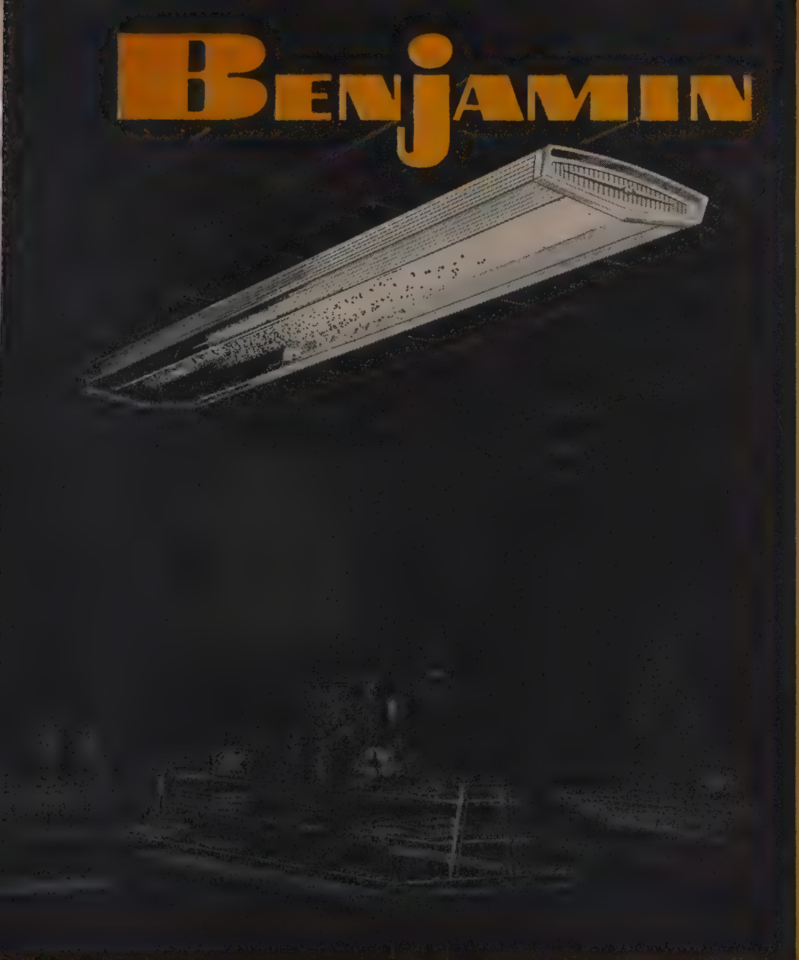
ANSWER TO Z39—A 1.0 pf synchronous motor is designed to take only energy current from the ac supply line when operating at full load. This improves the power factor of the system, because no excitation or wattless current is taken along with the energy current. Slow speed 1.0 pf synchronous motors are usually not built for excess excitation.

The 0.8 pf leading-type synchronous motor is designed to carry its rated load when it is drawing loading excitation current from the ac supply line. In this condition it will supply a certain amount of magnetizing current to induction motors.

Assuming that the wattless current, which you desire to pick up, is lagging current, it appears that the 1.0 pf machine is not built for operation with sufficient excess field current to result in leading power factor.

Your attempt to equate the kvar capacity of a 1.0 pf machine at 80%

BENJAMIN



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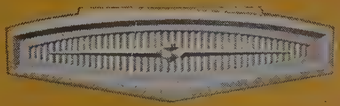
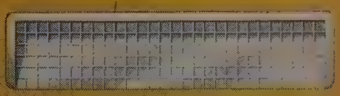
We're proud to offer two of the most distinguished designs available in the market today. Benjamin know-how has combined superior engineering and maximum lighting efficiency in smart, slim fluorescent fixtures, that add the note of distinction to any office or commercial installation. Dramatically decorative . . . competently functional.

No visible metal supports. Can be mounted singly or in continuous unbroken line. Variety of light-diffusing lenses for any purpose. Two or four lamp. Forty-eight inch lengths.



The incomparable CORONADO

Here is the latest development in controlled lighting—3 in 1 lens—snap-in wiring channel—only 2½" deep—two types of lens. Designed for surface mounting for all types of commercial lighting—offices, schools, banks and other interiors that require high quality illumination, realistically priced.



The distinctive *Catalina*

Today's most copied commercial fixture. Its beauty of design and universal adaptability make it the number one choice of architects and consulting engineers. Selected by contractors for its ease of installation. In either prismatic lens or plastic louvers, this unit has no equal.

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BENJAMIN LIGHTING DIVISION
207 East Broadway, Louisville 2, Kentucky

The World's Largest Single Source of Lighting for Home, Commerce and Industry

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combines temperature control with interchangeable wiring devices!

For bathrooms, kitchens, recreation rooms, and any place you need a room thermostat *combined in one mounting* with interchangeable switches or other devices . . . use the all-new Penn *Switchstat.*

Simple to install and easy to wire, *Switchstat* is beautifully designed to harmonize with any room decor. It offers more convenience than any other electric heat thermostat. You can easily install one, two or three wall switches . . . pilot light . . . convenience outlet . . . or any other combination of interchangeable wiring devices all in one attractive unit. Try it on your next job, you'll discover *Switchstat's* many advantages. Ask your wholesaler or write to Penn.

PENN CONTROLS, INC. Goshen, Indiana
EXPORT DIVISION: 27 E. 38th ST., NEW YORK, N.Y.
AUTOMATIC CONTROLS FOR HEATING, REFRIGERATION, AIR CONDITIONING, APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES

load with the kvar capacity of an 0.8 pf machine at 100% load is in error. Design of either machine would govern its kvar capacity. However, the 0.8 pf machine would take care of an amount of wattless current equal to its exciting current and of opposite phase relation.

In any power-factor-correction problem, which is to be solved by use of a synchronous motor, a study of the conditions is imperative. From data, the correct size and pf motor can be selected or designed. —G.M.O.

ANSWER TO Z39—A synchronous motor operating at unity power factor draws no reactive current from the line. On the other hand, it does not furnish any leading reactive current to compensate for the magnetizing current drawn by a large number of induction motors in a plant.

When a synchronous motor operates at leading power factor it means that not only does it draw no magnetizing current from the power system, but supplies magnetizing current for all or part of the induction motor load—according to the size and design of the synchronous machine.

You seem to believe that a synchronous motor will supply several times as much corrective effect at part load as it will at full load. However, this is not so. Take a 200-hp, unity-power-factor motor that operates at 50% load. At this load the efficiency will be about 92%. This would give us an input of about 108 hp or 81 kw. By plotting a curve it can be seen that the motor will operate at 92% leading power factor with a 50% load. Further calculations would result in a figure of approximately 34 rkva, which isn't a great deal of correction. In fact, it's about the same as you would get from a 60-hp, 80% pf motor running at full load.

As to your unity pf motor operating at 80% load, you may be surprised to learn that this will only result in a leading power factor of 98%.

The above information, together with formulas and tables, can be verified by referring to a book titled "Power Factor In Your Plant," by W. C. King, and available through the Cornell-Dubilier Electric Corp., South Plainfield, N. J. This book also describes the many ramifications involved in selecting the proper power-factor corrective equipment. Moreover, it gives the advantages and disadvantages of synchronous machines.—J.C.H.

WIREMOLD®
ELECTRIC IDEAS

PREPARED EACH MONTH FOR ELECTRICAL CONSTRUCTION AND MAINTENANCE TO BRING IDEAS, NEWS AND HELPFUL INFORMATION TO ELECTRICAL MEN.

62nd YEAR

SEPTEMBER 1961

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Strip Outlets Meet Buyer Demand For Convenience

Safety, adequacy not enough;
home buyers want convenience in electrical wiring

Electrical wiring, to the user, is but the means to the end — a method of making electrical power available. Today, he assumes home wiring will be safe and adequate. What he seeks is convenience.

Convenience, in user terms, means plenty of outlets located so as to avoid use of dangerous extension cords or cube taps.

How do you combine safety and adequacy with this kind of convenience? The logical answer is multi-outlet assemblies.

Of two standard references for electrical wiring, the National Electrical Code provides safety only, while the National Wiring Bureau's "Residential Wiring Handbook" affords safety and adequacy. Both fail to include convenience.

Following NEC requirements, on the basis of 3 watts per square foot, a residence with an area of 1,260 sq. ft. is provided with two branch circuits which serve general illumination and all receptacles except those for appliances.

Again, outlet spacing is determined on the basis of one receptacle for every 12 linear feet or major fraction thereof. Thus, a living room with a total of 60 linear feet is given five receptacles and an 11 x 12 bedroom is wired with four (fig. 1).

continued on next page

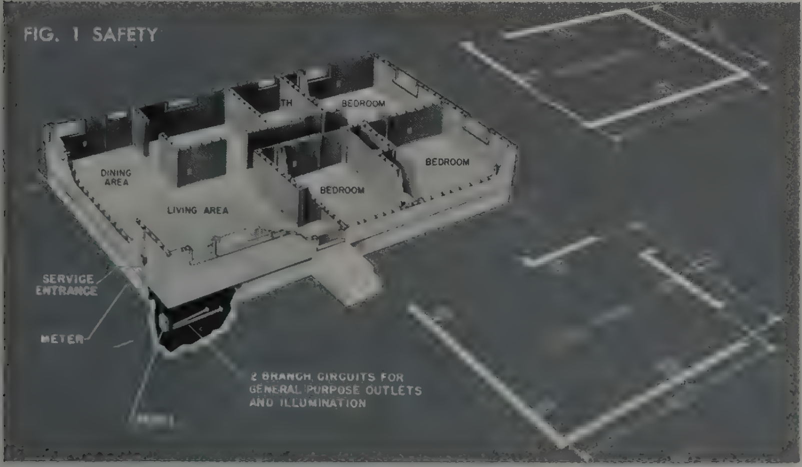
FIG. 1 SAFETY

SAFETY is obtained when the recommendations of the National Electrical Code are followed. By its own definition, the Code does not pretend to provide adequacy or convenience. All three are furnished when multi-outlet systems are used.

Code Comments

Permissible Load

Q. *What is the permissible load for a branch circuit having two or more outlets?*

A. Section 210-24 of Article 210 reads, "(a) 15- and 20-Ampere Branch Circuits. Lighting units and/or appliances. The rating of any one portable appliance shall not exceed 80 per cent of the branch circuit rating. The total rating of fixed appliances shall not exceed 50 per cent of the branch circuit rating when lighting units or portable appliances are also supplied. (b) 30-Ampere Branch Circuits. Fixed lighting units with heavy duty lampholders in other than dwelling occupancies; or appliances in any occupancy. The rating of any one portable appliance shall not exceed 24 amperes."

Low-Voltage Wiring

Q. *What is the maximum number of twisted cables allowed in Wiremold 2100 for low-voltage wiring?*

A. Articles 725 and 800 of the Code deal with remote control, low-energy power, low-voltage power and signal circuits, and communications circuits respectively. The limitations concerning the number of conductors to be used with the various Wiremold series are covered in the first sentence of Article 300, Section 300-17.

WIREMOLD®

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Editorial

How home buyers rate wiring

A survey conducted for HI-PO (Housing Industry Promotion Operation) reveals that home buyers rank "enough electrical power and wiring" as the third major consideration in home buying. This confirms what many of us in the electrical end of the business have been saying for some time.

Now that the builders themselves have been told this, it is up to us to convince them that adequate wiring is a necessity — and that *convenient* wiring is a merchandising plus.

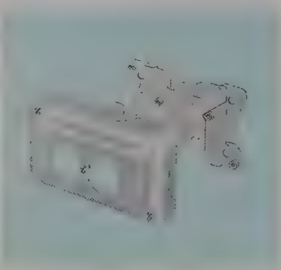
Multi-outlet systems have long been the hallmark of quality homes. The contractor who is proud of his work and thinks in terms of user acceptance will find that these surface systems offer an opportunity to sell-up a routine wiring job into a quality installation.

Product of the Month

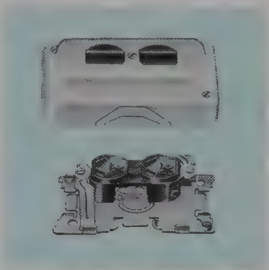
More effective Pancake installation with redesigned fittings

Two groups of fittings for Pancake® 1500 have been redesigned to include these features: cover fastened to the base for a stronger installation; combination No. 1500 and 2600 twistouts on four sides to provide greater versatility; and a new contour design for a neater overfloor installation.

Fittings in the redesigned groups are the 1543L Duplex Receptacle, the 1543AL Polarized Duplex Receptacle-3 wire; 1543GL Grounding Duplex Receptacle. Also, 1546A Single Receptacle Box; 1546B Duplex Receptacle Box; and the 1546T Telephone Outlet.



1546B



1543AL

1546T

Strip Outlets Meet Buyer Demand

continued from preceding page

By following the recommendations of the Residential Wiring Handbook, our 1,260 sq. ft. house is provided with three 15-amp. general purpose circuits compared with the previous two. This, then, begins to assure adequacy. How about convenience?

In general, the Handbook requires that outlets be placed so that no point along the floor line is more than 6 feet from an outlet in that space. In other words, an outlet for every 12 linear feet, the same as the Code (fig. 2).

Convenience can be a companion to safety and adequacy. Multi-outlet systems combine all three into neat, unobtrusive wiring.

Figure 3 shows the same house wired with Plugmold.® Five branch circuits service convenience outlets. The living room now has 16 outlets; the bedroom, 14.

Plugmold systems not only assure a satisfied customer, they give builders a selling advantage and the engineer and contractor the knowledge that they have furnished the ultimate in wiring — a safe, adequate and convenient system.

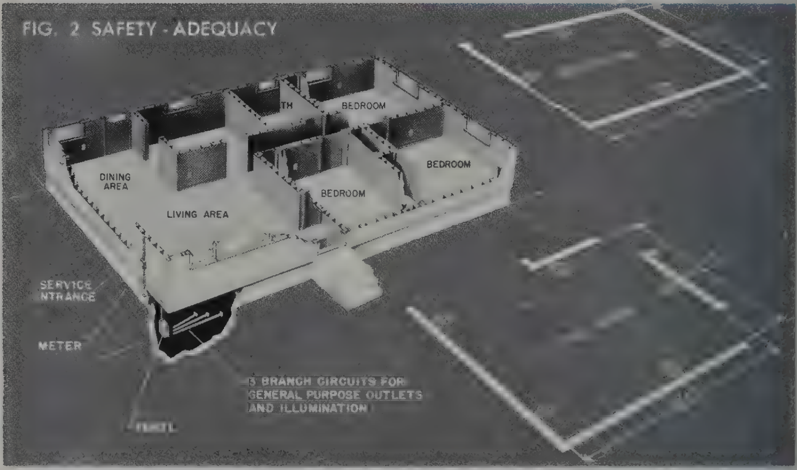


FIG. 2 SAFETY - ADEQUACY

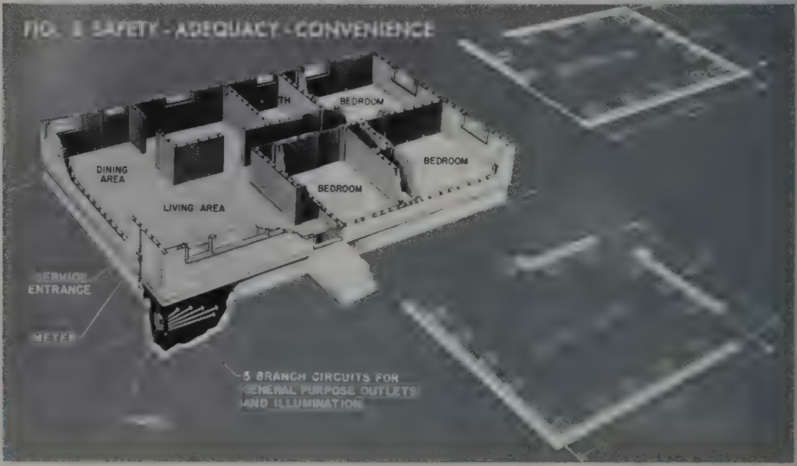


FIG. 3 SAFETY - ADEQUACY - CONVENIENCE

WIREMOLD®

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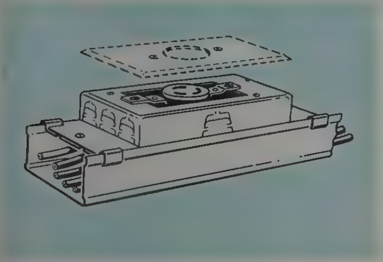
Quiz Corner

Questions for this department are taken from inquiries received from the field. Your questions are welcome; indeed, they are necessary if this department is to serve you with worthwhile information. Address:

Quiz Corner
The Wiremold Company
Hartford 10, Conn.

Q. *How would I mount a 30-amp. receptacle in 3000 Wiremold?*

A. Use 3046L Fustat Device Cover on a 5751 Flush Type Extension Adapter or any box with an extension base.



Q. *What is the difference between maximum permitted and recommended normal wiring tables?*

A. Recommended normal wire capacity is the capacity of the one-piece raceways when the installation involves bends and elbows. The number of Conductors under "Maximum Permitted Capacity" may be run in these raceways but they are recommended only for straight runs with no bends or elbows. See Page 9, Catalog 22.

Q. *Can I feed 2000 Plugmold from the side with conduit?*

A. Yes. Use a 2010A Entrance End Fitting and a 2015 Tee.

Q. *When using 1000 Wiremold what box is available for mounting 2 or 3-gang devices?*

A. The 1048 Switch and Receptacle Box is available in larger than 1-gang on special order.

Q. *Does Wiremold make a mounting strap for Plugmold 2000?*

A. No. A mounting strap is not needed. Plugmold base is mounted directly to the surface through the piercings which are provided every 7½ inches.

Q. *Can I get into 2200 Plugmold from 1" pipe?*

A. Yes. Use 2210D Entrance End Fitting.

Q. *How do I get out of a flush wall box into 3000 Wiremold?*

A. Use 3014C Wall Box Connector.

Q. *Wiremold flexible sections 200F, 5700F, and 1000F are furnished in 18-inch lengths. Are other lengths available?*

A. Yes, on special order.

WIREMOLD ■ HARTFORD 10, CONN. E1-9
Gentlemen: Please send me checked items

NAME ____________________
COMPANY ____________________
ADDRESS ____________________
____

☐ Electric Ideas, August 1961
☐ Electric Ideas, July 1961
☐ Wiring Guide (Catalog 22)

Advertisement

Personnel Notes

Wynne Snoots, Dallas, and Russ McKnight, Oklahoma City, represent Wiremold at Oklahoma City's IAEI meeting.

Tom Pugh, Baltimore, Dick French, Philadelphia, and Henning Thomsen, Home Office, will be on hand at Philadelphia's Convention Hall.

Tom and Dick then join Frank D'Esopo, Home Office, and Phil McGovern, New York, at the Warwick Hotel in the City of Brotherly Love.

Show dates and locations are listed under "Meetings Ahead."

Wynne Snoots

Russ McKnight

Tom Pugh

Dick French

Henning Thomsen

Frank D'Esopo

Phil McGovern

Meetings Ahead

Western Section, IAEI — Biltmore Hotel, Oklahoma City, Okla., Sept. 25-27.

Electrical Progress Show — Convention Hall, Philadelphia, Pa., Oct. 3-5.

Eastern Section, IAEI — Warwick Hotel, Philadelphia, Pa., Oct. 9-11.

WIREMOLD®

Engineered Specials

Twisted elbows developed for Wiremold 2100 and 3000

PROBLEM:

To provide a method of making a 90° twist with a 90° turn with Wiremold 2100 and 3000 series.

SOLUTION:

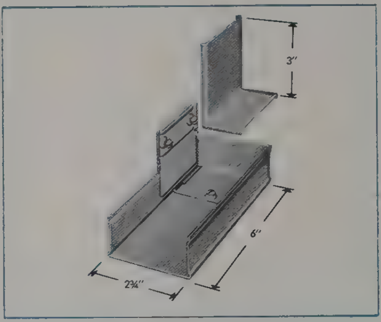
Use of specially-developed twisted elbows permits making a double right-angle turn, right or left hand, from one surface to another.

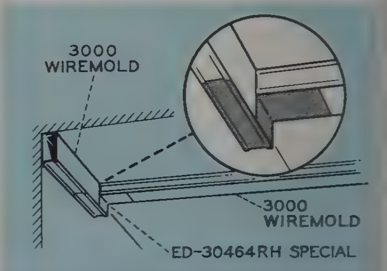
DISCUSSION:

Two internal twisted elbows have been developed to permit making 90° turn-and-twist combinations from one surface to another.

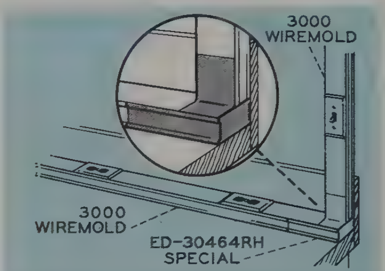
Both the ED-30600 Special, for Wiremold 2100, and the ED-30464 Special, for Wiremold 3000, are available on special order in right hand (RH) or left hand (LH) configurations. Elbow is furnished with right-angle cover section.

Wiremold engineers continually seek the development of products to solve in-field problems.

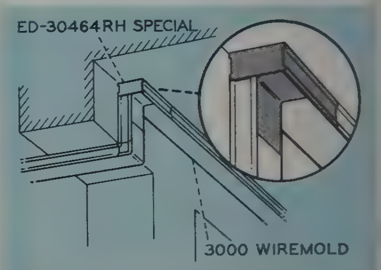




TWISTED ELBOW EXTENDS WALL-MOUNTED 3000 ONTO CEILING.



DOWN-FEED THROUGH TWISTED ELBOW TO BENCH-MOUNTED OUTLET STRIP.



FROM BEAM TO CEILING WITH TWISTED ELBOW TO AVOID COLUMN.

Ground to Ground

Each month we ask a question which, when answered, will help us improve our products and services to you. A frank answer will be appreciated. Answers will not be published, but will be acknowledged. Address:

Ground to Ground
The Wiremold Company
Hartford 10, Conn.

Each year manufacturers spend millions of dollars for literature designed to help their customers. Much of this fails in its purpose. What should the supplier do to make his literature most valuable to you? What size should it be? What type of punching, if any, do you like? How do you file literature? Are photographs or drawings better for you?

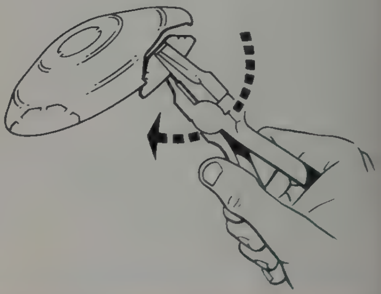
Practical Tips

Care key to simple, neat twistout removal

Care and proper methods assure twistout removal without distorting the metal.

For sheet metal parts, (1) locate the retention tabs and use them as a hinge or pivot point. (2) Hold the fitting in one hand while firmly gripping the TO with side cutters in the other hand. (3) Rock back and forth on pivot point until tab breaks off. (4) In multi-TO patterns, exercise care so that only one twistout at a time is removed.

In die-cast parts, (1) hold fitting in one hand while firmly gripping TO with side cutters in other hand. (2) Make certain nose of side cutters is in center of twistout and in as far as the edge of the TO outline. (3) A quick motion of cutters and fitting around the pivot point will break out the TO cleanly and neatly.



WIREMOLD®
HARTFORD 10, CONNECTICUT

All WIREMOLD products are sold through electrical distributors — your best source for all electrical products.

Can You Answer These QUESTIONS?

QUESTION H40—A portable filter for a swimming pool has a 1/3-hp motor, single phase, 110 volts, and is plugged into an outdoor receptacle. The equipment — motor, pump, tank, etc.—is mounted on a steel carriage with rubber tires and is grounded through the cable and grounding-type plug and receptacles.

Somebody, who once got an unforgettable electric shock from an outdoor portable electric appliance, classified this arrangement as extremely dangerous. The ground around the filter is mostly soaking wet, due to splashing from the pool and leakage on the filter; and children of all ages are running around it.

Is the above installation foolproof, or are additional safety measures required or recommended?—J. A.

QUESTION J40—I have run into a controversy on the use of explosion-proof pushbuttons with ground flanges and bolted covers out of doors. Some people maintain the ground flange surfaces are not suitable for use in the rain, and others maintain they are. I have used this type successfully out-of-doors with no water getting in the enclosure, but I have always kept the flanged surfaces clean and greased. Will someone who has had experience with this type of equipment please give me their viewpoint.—W.E.G.

QUESTION K40—We are planning on pulling three single-conductor, neoprene-jacketed 500 MCM 13.2-kv cables through a 100-ft run of 4-in. steel conduit that connects a manhole to a building. This conduit has been empty for 20 years and is coated with rust, and there is evidence that debris and mud have been deposited in it by the water that is normally in the manhole. Can someone suggest a method for cleaning out the pipe effectively and also a type of pulling compound to facilitate the pull? —R.E.B.

PLEASE SEND IN YOUR ANSWERS BY OCTOBER 15

ROYAL Portable Cords and Cables

Satisfy all your requirements . . . whether for extra heavy duty Type W power cable or light, flexible Type SJ cord.

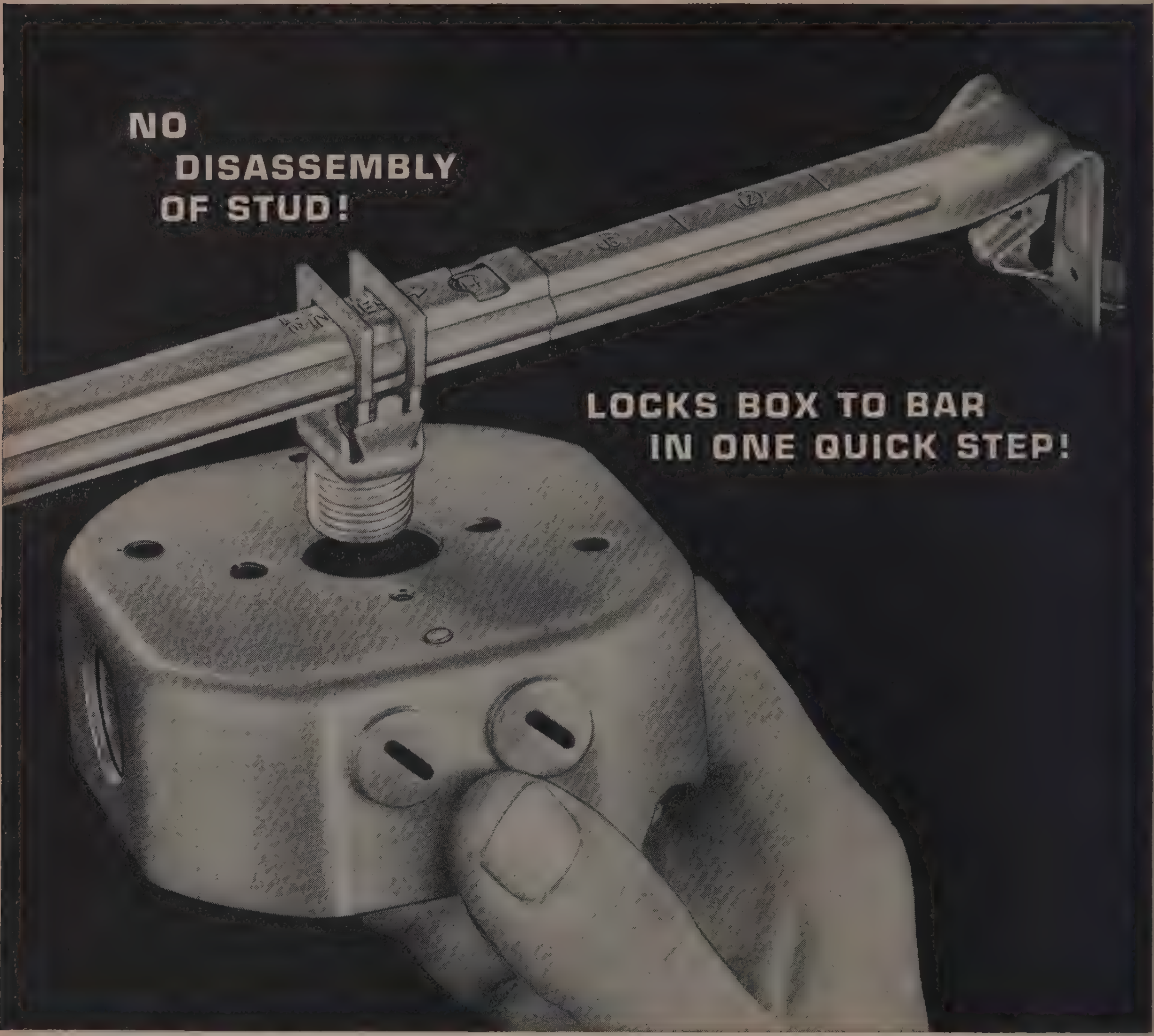
Yes, one call gets them all! All types and sizes in all kinds of jackets . . . rubber, neoprene or thermoplastic. Lamp cords, fixture or machine tool wire . . . thermo or coaxial cables. All ROYAL and reliable!

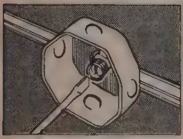
Ask for them by brand name from your wholesaler . . . or write for our catalog, giving your wholesaler's name.

ROYAL ELECTRIC ... an associate of ITT

ROYAL ELECTRIC CORPORATION
PAWTUCKET, RHODE ISLAND
In Canada:
Royal Electric Company (Quebec) Ltd., Pointe Claire, Quebec

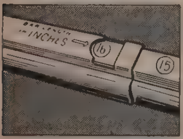
NEW EFCOR BAR HANGERS





CUTS ASSEMBLY TIME —— Just remove the outlet box knockout, slip box over bar hanger stud, tighten with screwdriver, and you're set! No parts to remove and replace.

Plus these added features for fast, dependable installation!



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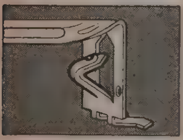

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Permanently locks prong into wood.

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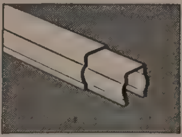

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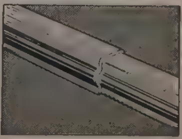

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Special rib-reinforced bar cross-section resists bending, twisting—takes 20% greater loads.

Available in both stud and no-stud assemblies. Can be reversed for additional installations. Just two bar sizes cover any length from 11½" to 26½". Also available in preassembled box and bar units. SEND FOR FREE SAMPLE.

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Questions on the Code

Answered by:
B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*
R. E. WARD, *Chief Electrical Inspector, Insurance Department, State of Tennessee, Nashville, Tenn.*

Meter-Socket Installations

Q. *Below is a sketch of a service-entrance conduit run and a gang of 3-opening meter sockets connected together with pipe nipples.*

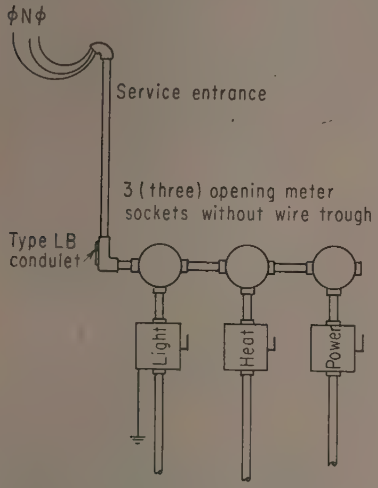
NEC Section 373-8 prohibits such method in case of a group of switches, but in a case of a group of meter sockets, we are not sure.

Please let us have your opinion on this matter.

1. *Does Section 230-42, Exception No. 1, which permits "clamped or bolted connections in a meter enclosure," mean that a gang of meter sockets with third opening connected together with pipe nipples be permitted?*

2. *If the answer is no, then is there any other part in the code where this method of multiple metering is permitted as a service equipment?*

3. *Does the code prohibit the use of fittings on the service entrance conduit run such as the Type "LB" fitting shown in the sketch?—Y.N.*



Method sometimes used where 3 rates prevail in an Electric Utility Co., or where multiple occupancy in an apartment

A. For the convenience of our readers the provisions of Section 373-8 are quoted as follows:

"Switch Enclosures. Switch enclosures shall not be used as junction boxes, troughs or raceways for conductors feeding through or tapping off to other switches, unless designs suitable for the purpose are employed to provide adequate space for this purpose."

This rule, which first appeared in the 1946 Code, reduces the hazard which results when conductors are crammed in switch enclosures where the movable parts of switch mechanisms chafe the insulation and cause it to fail. Enclosures for standard knife switches are designed only to accommodate the conductors incident to the function of a switch. As a result, conductors foreign to the duty of a switch are not permitted unless the above quoted rule is satisfied. While a meter socket with its meter may be classified as a switch, I doubt that such a combination was considered when the rule was formulated. According to Webster a switch is "a device to break an electric current or transfer it to another conductor." According to the NEC, a switch is not defined. The code definitions speak only in terms of use, form and rating. While a meter socket and its meter perform the function of a switch, I am inclined to believe that the provisions of Section 373-8 do not apply. To me, such an interpretation would be an abnormal distortion of the rule.

In support of this opinion, Underwriters Laboratories, Inc. list, under their label service, meter sockets with the following quote:

"Meter sockets consist of assemblies of enclosure, wiring terminals and contact jaws for plug-in types of watthour and similar meters, and provide for fastening of the meter to the socket. Meter sockets do not include overcurrent devices, normally arcing parts or the like; they may include provision for current transformers but not the transformers.

"Devices listed as meter sockets may accommodate from one to 12 meters.

"Ratings of listed meter sockets are limited to 600 volts ac maximum and to 200 amps maximum through any meter. Meter sockets accommodating two or more meters also have an over-all ampere rating. Meter sockets having provision for current transformers also include the maximum transfer current rating.

"Meter sockets listed herein are for use with copper conductors unless marked to indicate which terminals are suitable for use with aluminum conductors. Such marking shall be independent of any marking on terminal connectors and shall be on a wiring diagram or other readily visible location.

"Wire connectors in listed meter sockets are intended to accommodate one conductor only unless use with more than one conductor is clearly indicated on the wiring diagram or other readily visible locations."

It is significant to note that no reference is made to the characteristics of a switch. When a meter socket is provided with three hubs as shown on your diagram, and is listed by UL, there is no occasion to question the provisions of Section 373-8. On pages 28 and 29 of the September 1960 issue of EC&M, the Square D Company illustrates meter sockets accommodating nine meters. This unit assembly, approved by UL, appears to be a proper solution to the meter socket problem. This comment does not infer that the installation illustrated by you is in violation of code rules.

The provisions of Section 230-42, Exception No. 1, are intended to cover the situation which prevails when the meter is located on the line side of the service switch. Under such circumstances, splices or bolted connections are necessary to connect the socket to the service-entrance conductors. In my opinion, it covers the application shown on your diagram. It is important to note, however, that the UL advice, quoted above, which directs our attention to the number of conductors connected to a terminal, must be satisfied.

The provisions of Section 230-52 are general in nature, and require all types of rigid metal raceways, used for services and exposed to the weather, to be made raintight. In order to satisfy this code provision, an "LB service-entrance elbow" has been developed. One design is provided with a gasket and blank sheet-steel cover having end wedge nuts. The other has a blank cast cover having break-neck locking screws.—B.A.McD.—9/61/1

JOB-PROFIT TOOLING IDEAS

FROM GREENLEE

"We saved several thousand dollars with GREENLEE TOOLS on a complicated missile site contract,"

says FRED S. BREECE

superintendent of electrical construction
for A. NERI, Inc., of California

A. Neri, Inc., of California, is the electrical contractor for three Titan missile-launching complexes near Mountain Home, Idaho. Specifications for this job call for approximately 345,000 feet of rigid conduit and over 90,000 feet of thin-wall conduit. Installation requires more than 14,000 bends and 2,000 knockout openings for distribution and junction boxes.

Ralph Neri, assistant superintendent on the job, reports, "We are using Greenlee benders, knockout punches, and punch drivers exclusively. In most cases we have been able to take the tools right to the conduit instead of taking the conduit to the tools . . . and get the job done faster."

This view (right) of one of the missile-launching sites gives some idea of the complexity of this job. The cylindrical structure still in the forms is the entrance portal for the entire complex. The concrete dome will house the control center. When the work is completed, all these structures will be completely underground.

Work area in the tunnels and other structures in the missile-launching complex is so limited that A. Neri, Inc., set up a prefabricating shop where bends in various diameter conduit are made on Greenlee benders. The finished bends are then taken to the construction site for installation, substantially reducing the man-hours required to complete the job. Two No. 884-E one-shot benders with 4″ capacity, and powered by Greenlee No. 798AC-SA two-speed hydraulic power pumps, are used in this prefab shop.

Bending conduit right on the job is done on three Greenlee No. 880-M2 benders like the one shown above. Breece reports the light weight and compactness of these tools are a definite advantage to job efficiency in the confined work areas of the tunnels. All benders are operated either by Greenlee hydraulic hand or power pumps. According to Breece, there have been no major repair or maintenance costs with any of their Greenlee tools — another big saving for A. Neri, Inc.

To complete this job, workmen for A. Neri, Inc., will make over 4,000 bends in 90,000 feet of ½″ through 2″ thin-wall conduit, using three Greenlee No. 880-M2T thin-wall benders (as pictured above).

For total bending work on both thin-wall and rigid conduit on this contract, Breece estimates his company will save several thousand dollars through the use of Greenlee benders.

"We also should save by using Greenlee knockout punches and drivers," Breece states. To speed the work of making over 2,000 knockout openings for ½″ through 4″ diameter conduit, A. Neri, Inc., is using Greenlee No. 7310 hydraulic knockout driver and punch sets (as shown above), Greenlee No. 1731 one-shot knockout punch driver, and the No. 1804 ratchet knockout driver.

Greenlee equipment used for this contract was purchased from National Electric Supply Company, Oakland, California, whose representative worked closely with A. Neri, Inc., in providing the right tools for each job. For help in selecting the exact GREENLEE JOB-PROFIT TOOLING needed to streamline *your* operations, help control costs, and assure a better return on your tool investment, see your Greenlee distributor . . . or write for Bulletin E-240A today.

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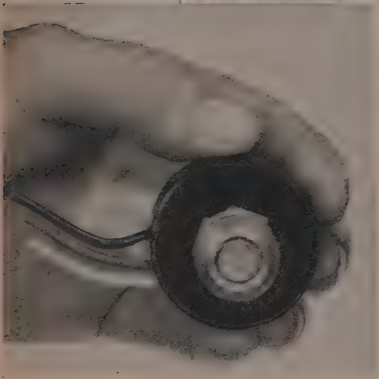

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Switch-Leg Size

Q. *Is it approved by the code to use No. 14 wire for switch legs for a single light fixture on either 20-30-amp branch circuits?—K.M.*

A. If these switch legs can be kept to a total length of 18 in. they can be so installed. In general, the 1959 Code has been changed so that the switch-leg taps are required to be of the same size and capacity as the main branch-circuit conductors. The size of the branch-circuit tap conductors is now covered in Paragraph 210-19(c), Exception No. 2. Specifically, sub-paragraphs (a) and (b) cover this question.—B.Z.S.—9/61/2

Switch Position

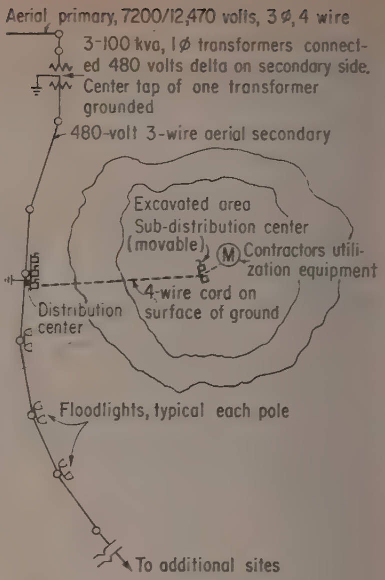
Q. *Under what section of the code can an inspector reject a job due to the service switch being mounted in a horizontal position?—A.E.*

A. Paragraph 240-17(c) answers your question, and is as follows: "Enclosures for overcurrent devices shall be mounted in a vertical position unless in individual instances this is shown to be impracticable."

This is another place in the code where an inspector must rule on a special condition according to the practical aspects of the particular job in question.—R.E.W.—9/61/3

Grounding Temporary Installation

Q. *At a construction site for a missile base, I have come up against a perplexing problem in grounding. To supply power and lighting for construction, the contractor has erected an aerial distribution system around the construction area, consisting of open wires on crossarms supported 70 ft in the air by wooden poles. The power is 480 volts, 3-phase 3-wire delta, supplied from three single-phase delta-connected transformers. The center tap of one of the transformers is grounded at the pole on which the transformers are mounted.*


Aerial primary, 7200/12,470 volts, 3ø, 4 wire
3-100 kva, 1ø transformers connected 480 volts delta on secondary side.
Center tap of one transformer grounded
480-volt 3-wire aerial secondary
Excavated area
Sub-distribution center (movable)
M
Contractors utilization equipment
4-wire cord on surface of ground
Distribution center
Floodlights, typical each pole
To additional sites

At strategically located poles, distribution centers consisting of safety switches on a plywood backboard provide take-off points for long rubber-covered cords which extend down into the excavated areas. In the excavated areas, additional safety switches on a skid-mounted frame serve as branch-circuit distribution centers to the utilization equipment. Much of the utilization equipment consists of 440-volt motors. The accompanying sketch illustrates the above description.

Grounding of the motors is accomplished by a grounding conductor in the flexible cord to the motor. However, the conductor eventually returns to a ground rod at the distribution center. In the event of a fault, the current would have to return through this rod to ground, then through earth to the ground rod which grounds the center tap of the supply transformer. This is a high-impedance path which will probably limit the current below that required to operate the branch-circuit protective device.

In addition, the resistance of the ground rod to earth at the distribution center is quite high (approximately 250 ohms). At the location of the utilization equipment, a thoroughly wet surface exists. Thus, it would be possible for a workman to provide a ground path of lower resistance than that provided by the grounding system.

Would the code require a grounding conductor to be carried throughout the distribution system under the above conditions? Are there any acceptable alternate solutions recognized by the code? I have referred to the article "Grounding and the National Electrical Code," by Eustace C. Soares, which appeared in the November 1959 issue of EC&M. From this, it would appear that a grounding conductor

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from the center-tapped 480-volt transformer is required.—D.J.N.

A. In so far as code rules are concerned, the distribution system under discussion could be grounded or ungrounded, since the maximum voltage of any phase conductor to ground exceeds 150 volts. In fact one phase to ground exceeds 300 volts. According to the provisions of Section 250-5, the code recommends the grounding of an ac system when the voltage to ground does not exceed 300 volts, and it merely recognizes the grounding of systems exceeding 300 volts to ground. This is an alternate procedure recognized by the code with the new 1959 recommendation that such systems be equipped with ground detectors. A literal interpretation of Section 250-5 indicates a preference for grounding when the system operates at 300 volts or less to ground, but it also infers that an ungrounded system is desired when the voltage to ground is greater than 300 volts. In the case in question, only one of the phase conductors operates at more than 300 volts to ground. In view of the fact that the installation is of a temporary nature, where both equipment and wiring may be subject to unusual mechanical injury, it is quite possible that a grounded system properly installed and maintained would be preferred. It also appears that the occasion for system grounding concerns the floodlights served by phase conductors operating at 240 volts to ground.

According to your diagram, we have a situation where the system is grounded at the transformers, but the grounded conductor is not brought to the various distribution centers. As a result, we may have a high-impedance ground circuit which, as you say, will probably limit the current below that required to operate the branch-circuit overcurrent device. Mr. Eustace C. Soares has covered this question at considerable length in his excellent article and I believe it would be difficult to successfully refute his contentions.

The 1940 edition of the code required "the grounded conductor of the secondary distribution system to be run to each building served." During World War II, this code provision was deleted by Interim Amendment No. 52, approved June 17, 1942. Conservation of copper may have been a factor. During the past couple of years, inspectors from various sections of our country are inclined to believe that the 1940 rule should again be recognized by the code. Undoubtedly Mr. Soares' paper on "Grounding" has emphasized the importance of a metallic ground circuit.

The provisions of Section 250-24 also recognize the significance of grounding at individual buildings as follows:

"250-24. Two or More Buildings Supplied by a Single Service. Where more than one building is supplied by the same service, the grounded circuit conductor of the wiring system of any building utilizing one branch circuit supplied from such service may be connected to a grounding electrode at such building, and in the case of any building housing equipment required to be grounded or utilizing two or more branch circuits supplied from such service, and in the case of a building housing livestock, shall be so connected."

The occasion for this rule was prompted to a considerable degree by adverse experience on farm properties. Made electrodes coupled with equipment grounding only, and a building located several hundred feet from the secondary ground, produced a situation similar to that described in your question. The high-impedance ground circuit would not permit sufficient current to operate the protective device. As a result, potential hazards to people and animals existed for long periods of time, and were only discovered when the farmer lost a cow due to electrocution, or his electrical service bill became fantastic.

In the example shown, I personally believe on the basis of the fundamental Section 250-51 that the degree of safety would be considerably improved, if we considered each "distribution center" as a building, and the secondary grounded conductor be brought to such distribution centers, and again be grounded through a common grounding conductor. Such procedure would provide a metallic low-impedance grounding circuit. On a temporary electrical installation where mechanical injury is a factor of importance, maintenance becomes a prime consideration. The hazard of 480-volt circuits operating at 240 volts to ground should not be discounted. The entire electrical installation should be inspected frequently with particular attention given to the condition of the cords and the integrity of the grounding system. A fault on a cord could introduce a high-impedance path to the grounding electride.—B.A.McD.—9/61/4

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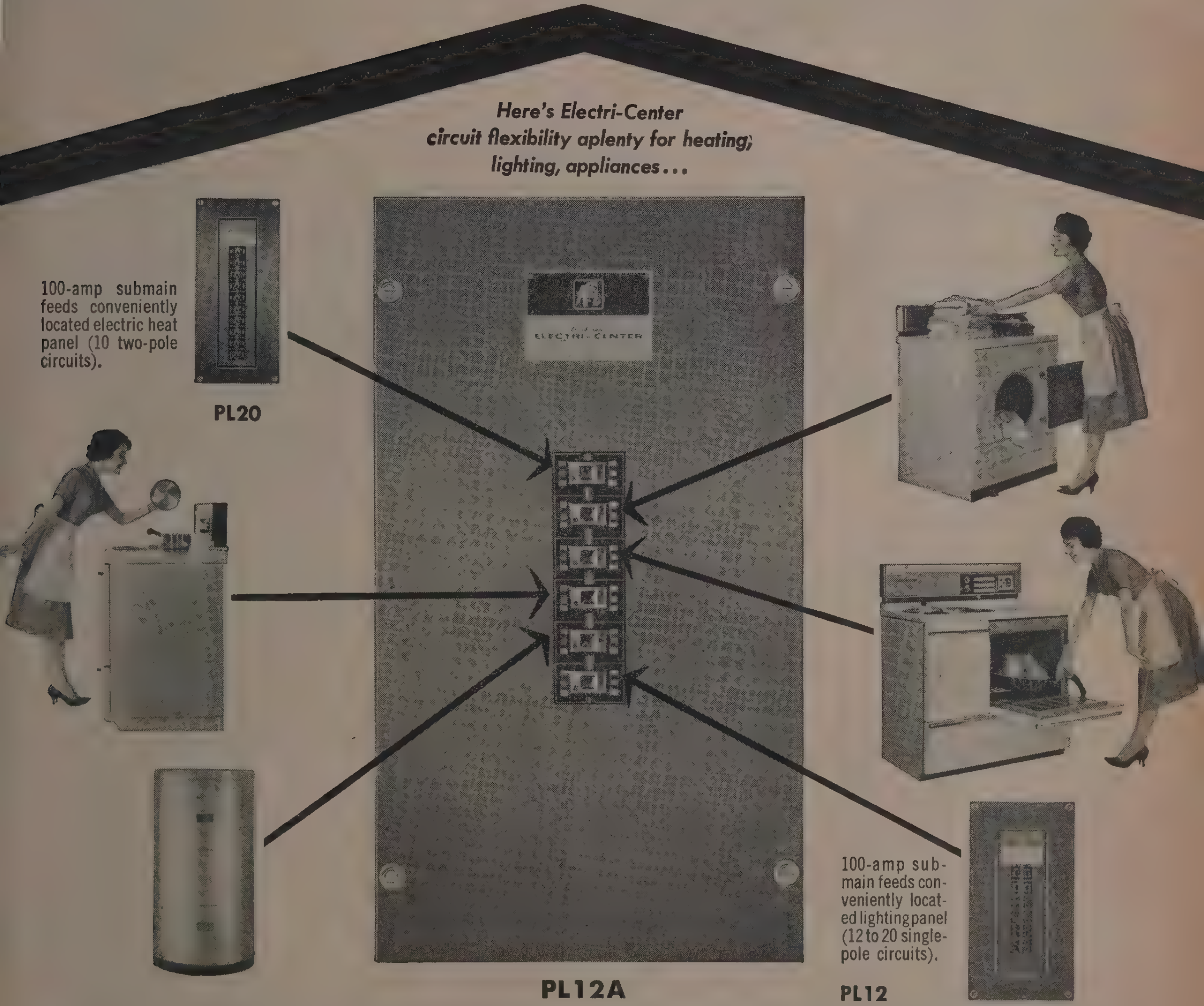

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Originated by BullDog expressly for service distribution in all-electric homes, the Pushmatic® 200-amp PL12A Electri-Center® provides any combination of circuits up to 24 poles . . . and allows location of subpanels for customer convenience—and *wiring convenience!* Other 100- and 200-amp Electri-Center panels provide a wide choice that meets all other residential requirements.

Pushmatic circuit breakers protect two ways! In Pushmatic breakers from 15 to 50 amps, a built-in time-delay prevents nuisance tripping from harmless, normal current inrush, but assures positive protection against dangerous overloads. In every Pushmatic, a magnetic coil trips immediately, *without* delay, if a short circuit occurs. By combining these two safety systems, Pushmatic breakers assure dependable protection under all residential load conditions.

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Switch Enclosures

Q. *Section 373-8 states that "switch enclosures shall not be used as junction boxes, troughs or raceways for conductors feeding through or tapping off to other switches,* UNLESS *designs suitable for the purpose are employed to provide adequate space for this purpose."*

Whose judgment is used in determining whether a switch has adequate space to be used for the above-mentioned purposes?—J.E.F.

A. One of the code rules that is frequently used by electrical inspectors is Section 90-7, which states in part: "The administrative authority supervising such enforcement of the code will have the responsibility for making interpretations of the rules, for deciding upon the approval of equipment and materials, and for granting the special premission contemplated in a number of the rules."

Some switch enclosures, which have much more space than others of the same rating, could be used in a limited way as outlined in Section 373-8. On the other hand, some switches and similar equipment are only designed with clearances to accommodate a limited number of conductors (usually line and load conductors) and cannot be used for other purposes. In any event, it is much more desirable to provide auxiliary gutters or similar enclosures to distribute wiring at a group of safety switches.—R.E.W. —9/61/5

Raceways Exposed to Different Temperatures

Q. *An installation of switches mounted on the outside of a cold-storage vault has a hub at the bottom rear of the switch and feeds through the wall in conduit to a point immediately inside of the vault where a seal-off of the self-draining type is installed. At this point, a rubber-covered (3-conductor, one for grounding the lighting fixtures) conductor cable runs up to the ceiling where the lighting fixture must be installed. This type of installation has not given any trouble to date and we want to know if it is satisfactory according to the NEC.—A.B.*

A. Yes, provided the conductors are of the proper approved type and the installation is approved for the location. Section 300-6 recognizes and requires sealing-off of the different sections of the conduit systems pretty much in the manner in which you describe in your general statement.—B.Z.S.—9/61/6

NEC Official Interpretations

Six official interpretations of the current edition of the National Electrical Code have been announced by the National Electrical Code Committee of the National Fire Protection Association, effective April 25, 1961. Each interpretation has been developed through the established committee procedure in response to requests and has been reviewed and released by the NFPA Electrical Correlating Committee.

Subject matter and official texts of the interpretations follow:

INTERPRETATION NO. 462
(Article 500)

Subject—Installation of intrinsically safe control circuits in hazardous areas.

Statement—A low-voltage, low-current electrical circuit of such value that the circuit may be considered intrinsically safe has been designed for use in hazardous locations so that nonhazardous controls may be placed in the hazardous area to actuate circuit interrupting equipment installed outside the hazardous area. This circuit - interrupting equipment controls high-energy circuits to equipment in the hazardous area. Both the high-energy circuits and equipment in the hazardous area are to be installed in full conformance with the applicable provisions of Article 500.

Question—May the intrinsically safe control circuit utilize, as part of the return circuit, the metal enclosure in which it is run without being in violation of the intent of the National Electrical Code?

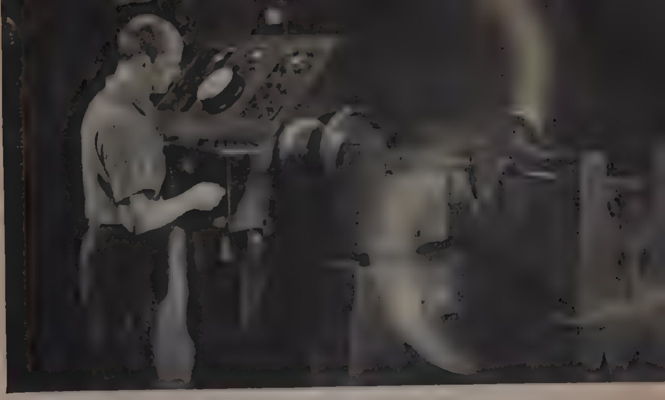
Answer—No.

INTERPRETATION NO. 463
(Sections 210-7 and 250-112)

Subject—Grounding of nonmetallic sheathed cable in a new installation.

Statement—Grounding receptacles

, **Clean, Quiet.** Vent pipe sucks in outside air, *pressure-cools* anently lubricated Ilg-built motors—designed to provide op- ıg cost advantages of *open-type* motors plus the protection of *y enclosed* types.



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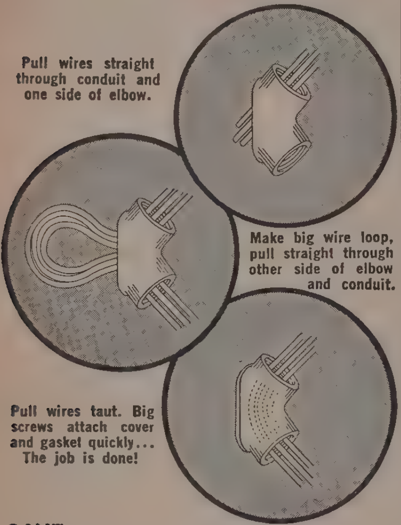
Pull wires straight through conduit and one side of elbow.
Make big wire loop, pull straight through other side of elbow and conduit.
Pull wires taut. Big screws attach cover and gasket quickly... The job is done!

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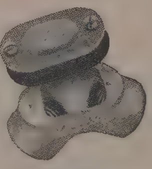
PNF TYPE PULLING ELBOW
Two female threaded hubs at 90° angle. Domed cover, full gasket. Sizes ½" through 2".



PNH TYPE PULLING ADAPTER
Two hubs, one female threaded, one male threaded, at 90° angle. Domed cover, full gasket. Sizes ½" through 2".

"L" TYPE PULLING ELBOW
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on a new installation are installed as specified by Sections 210-22(b) and 250-59. The branch-circuit wiring method is nonmetallic sheathed cable 14/2 without grounding conductor. A separate No. 14 copper conductor is installed as a grounding conductor from an adjacent water pipe to the grounding contacts of the grounding-type receptacle. Proper fittings and devices are used as required by code.

Question 1—Is the intent of Section 210-7 complied with under the above-outlined condition?

Answer—No.

Question 2—Is it the intent of Section 210-7 that the grounding conductor be an integral part of the cable assembly supplying the grounding type receptacle?

Answer—Under the condition noted—yes. On existing two-wire nonmetallic-sheathed cable, grounding may be through separate conductors to adjacent water pipe, as indicated in the last sentence of paragraph (a) of Section 250-112.

INTERPRETATION NO. 465
(Sections 230-90 and 230-70-g)

Subject—Capacity of service-entrance conductors when oversized feeders and main breakers are used to reduce voltage drop; also the provision of a separate circuit breaker without use of a main disconnect in an emergency lighting circuit placed ahead of the main circuit breakers.

Statement No. 1—The calculations for the wiring of a commercial establishment indicate that six feeders, each with conductor capacity of 100 amps, would be ample to serve the load. This would normally require six 100-amp circuit breakers and service-entrance conductors of proper capacity for the calculated load. For the purpose of preventing voltage drop, however, two of the feeders were increased to 150-amp sizes each, and four were increased to 125-amp sizes each, and circuit breakers corresponding to the increased feeder sizes were proposed.

Question No. 1—In view of the increased circuit-breaker ratings but with no increase in calculated load would the service-entrance conductors as originally calculated comply with Section 230-90 of the code?

Answer—Yes.

Statement No. 2—In the same layout just described, a separate circuit ahead of the six main circuit breakers is desired for emergency lighting as permitted by Section 230-72.

Question No. 2—Would the provision of a separate circuit breaker for this emergency lighting circuit, without the use of a main disconnect, comply with paragraph (g) of Section 230-70?

Answer—Yes.

INTERPRETATION NO. 466
(Section 250-92-a)

Subject—Installation limitations on a bare No. 6 grounding conductor.

Statement No. 1—A bare No. 6 system grounding conductor for a commercial building is 120 ft long. This conductor runs through a 4-in. concrete slab without being encased in conduit, electrical metallic tubing or cable armor.

Question No. 1—Is this permitted by Article 250, Section 250-92(a) of the NEC, 1959?

Answer—No.

Statement No. 2—Same situation as in "1" but the bare No. 6 system grounding conductor is laid on a sandy loam without conduit, electrical metallic tubing or cable armor enclosure and a 4-in. concrete slab poured over it.

Question No. 2—Is this permitted by Article 250, Section 250-92(a) of the NEC, 1959?

Answer—No.

Statement No. 3—Same situation, but the bare No. 6 system grounding conductor is run perpendicular through a 4-in. concrete slab and run below the slab in earth at a depth of 1 ft without a conduit, electrical metallic tubing, or armor cable enclosure.

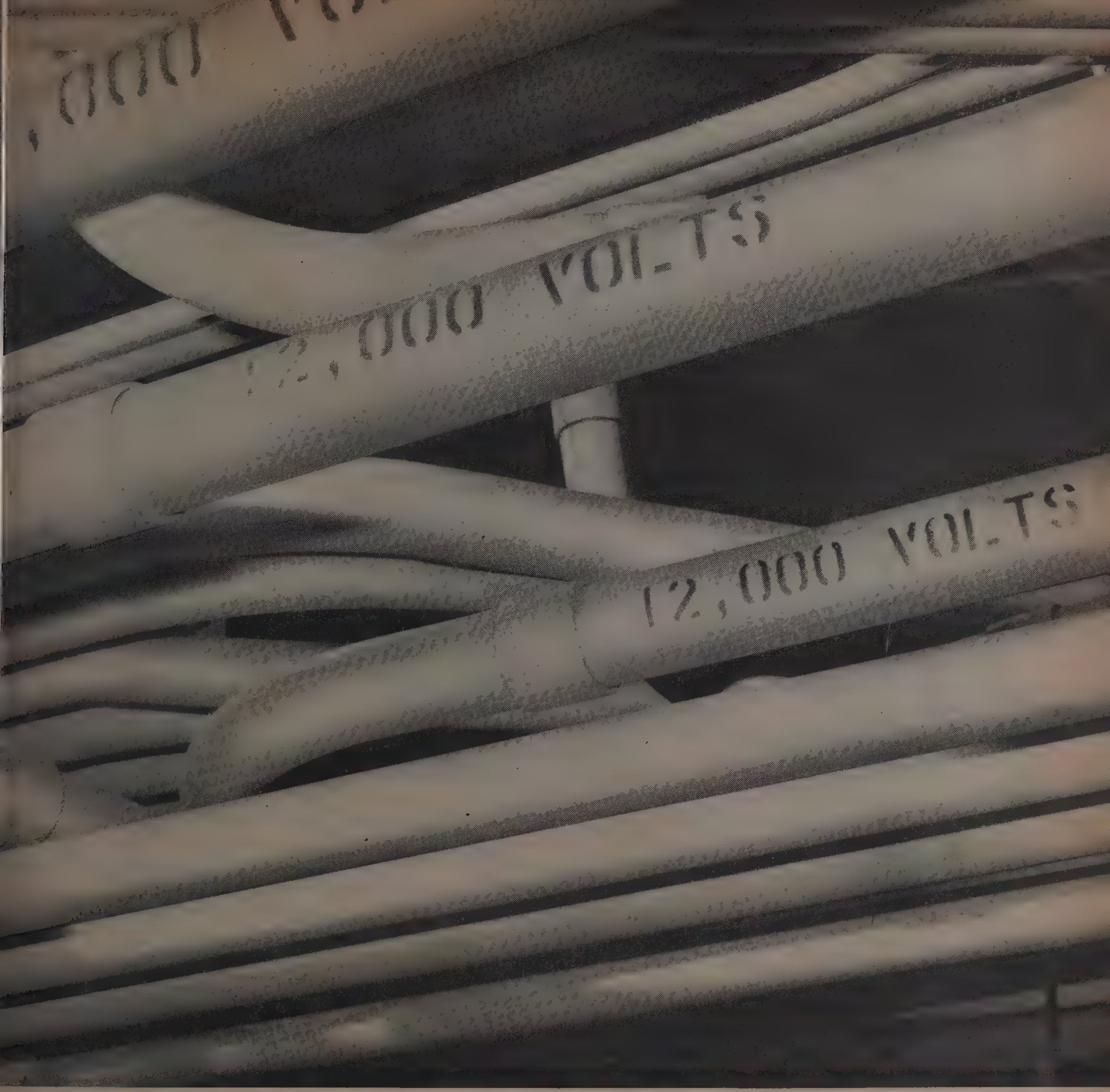
Question No. 3—Is this permitted by Article 250, Section 250-92(a) of the NEC, 1959?

Answer—No.

Comment—Attention is also called to Section 230-30(a), Exception No. 2.

INTERPRETATION NO. 467
(Section 230-4)

Subject—Application of the 300-volt-to-ground limitation with regard to the installation of a bare



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Question—On customer-controlled services, does Section 230-30 permit a bare neutral regardless of the voltage to ground, or does the 300-volt-to-ground limitation of Section 230-4 apply?

Answer—The 300-volt-to-ground limitation of Section 230-4 applies.

INTERPRETATION NO. 468

(Notes to Tables 1, 2, and 3, Chapter 9)

Subject—Application of code requirements to the cable assembly connecting a combination ventilating hood and control panel for installation over a counter cooking unit, the entire assembly being one approved by a recognized testing laboratory.

Statement—A manufacturer provides a combination hood-type ventilating-fan and control panel for installation over a counter-insert cooking top. The manufacturer also provides as part of the assembly a length of flexible steel conduit (maximum length 15 ft) enclosing heat-control switching conductors, which terminate in female-type plug-in connectors for connecting the hood and the heating sections together. Connection to the branch-circuit conductors is made at the combination ventilating hood and control panel. The entire assembly, including the connecting length of flexible steel conduit, is approved by a recognized testing laboratory.

Question No. 1—Is it intended that Section 210-19, paragraph c, Exception No. 2 be applied to the cable assembly connecting the combination ventilating hood and control panel to the cooking top unit?

Answer—No.

Question No. 2—Is it intended that Table 3, Chapter 9, be applied to the cable assembly connecting the combination ventilating hood and control panel to the cooking top unit?

Answer—No.

Comment—The short length of flexible steel conduit and the enclosed conductors are considered to be a part of the wiring of the appliance and as such are covered by the requirements of the standard under which the product is approved by the nationally recognized testing laboratory. See Section 90-8.

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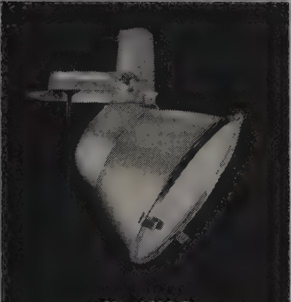
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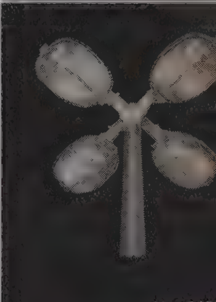
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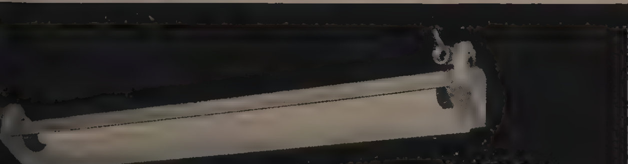
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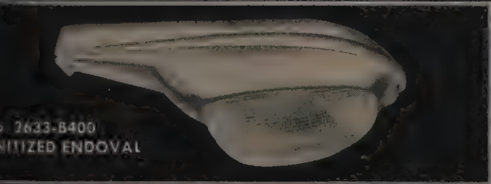
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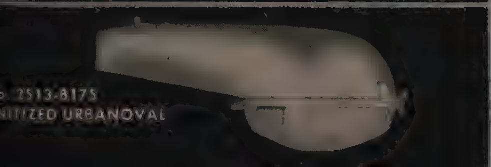
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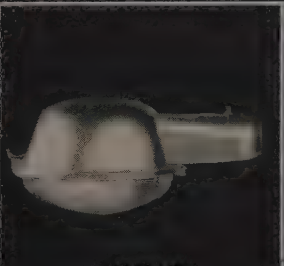
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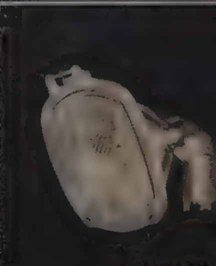
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Western Plant Maintenance Conference Staged in Los Angeles

Major theme for a 2-day Plant Maintenance Conference held in Los Angeles, July 18-19, was How to Increase Profits by Reducing Overhead. Concurrently, an informative exhibit of practical products and services related to the maintenance field indicated that, as new production equipment grows in complexity, more sophisticated test equipment and maintenance know-how is demanded of (and available to) men entrusted with this responsibility. As stated by Chairman L. C. Morrow, consulting editor, *Factory*, "The conference was short on theory but long on facts based on practical experience."

In the interest of national economy, the conference offered recommendations for avoiding costly shutdowns and improving maintenance efficiencies, and it also showed how savings in maintenance costs could directly improve over-all industrial profit margins. As indicated by this review, discussions were directly concerned with management, engineering and executive-level policy-making problems rather than with basic how-to technique or procedures. Emphasis was placed upon human relations and leadership, organization and delegation of responsibility, work measurement and incentives, maintenance planning and scheduling, budgets and indirect costs, engineering and labor-management considerations.

Organizing an effective 400-man maintenance division in a metal fabrication plant was the subject of a talk by Robert G. Keizur, superintendent of maintenance planning, Kaiser Aluminum & Chemical, Spokane, Wash., who maintained that only by planning can a maintenance supervisor control schedules and work backlog, develop budgets and cost-control procedures, keep accurate records of machine histories and repair costs, develop work standards and determine production performances. Maintenance is a costly necessity, he said, although it is possible to reduce those charges (on a per-unit-of-production basis) by proper budgets, schedules, controls and by promoting "receptive attitudes" with management and operational representatives. These various points were illustrated with actual experiences and examples, while an unusually active question-answer session indicated the high interest of those in attendance.

Many of Keizur's conclusions were echoed by Kendall J. Gibson, superintendent, Mechanical Div., American Oil Refinery, Casper, Wyo., who discussed reorganization of his maintenance set-up from a traditional craft type to an area responsibility arrangement. Placing needless emphasis upon jurisdictional lines had lessened efficient use of maintenance labor, he maintained; a fact which was acknowledged by union representatives who cooperated with the changeover.

When need for this change had been recognized and anticipated benefits had been examined, new procedures had been planned and endorsed by all interests involved (management, labor, production, maintenance). This changeover had involved training programs to improve supervisors' knowledge of craft details, psychology, leadership and delegation of responsibility, he said. Gibson then reviewed procedures for scheduling labor and materials for normal and emergency maintenance assignments, arranging planned shutdowns, writing job tickets and maintaining inventories. He also stated that, by informing all persons of true objectives and costs, cost-consciousness had improved all along the line; and, instead of routinely calling for a maintenance crew, supervisors now reconsider their requests, frequently scaling-down or cancelling their demands, planning more carefully and thereby conserving maintenance manpower and dollars.

Principles pertaining to planning and scheduling also were discussed by R. H. Price, maintenance superintendent, Pittsburgh Plate Glass, Corpus Christi, Texas, who defined planning as "detailed analysis of specifics, equating their importance to over-all objectives," and scheduling as "putting the right men on the job at the right time with the right tools and materials." He maintained that proper planning requires knowledge of the type of operations involved (heavy or light, bench work or jobsite, etc), complexity and scope of the work, also whether the job is routine, repetitive or non-standard in nature.

Price advocated using a combination of craft-area operations, permitting crafts to handle large or special jobs while area crews take care of jobs of lesser scope or complexity. He also stated that strict adherence to a preplanned daily work schedule was not a sacred obligation, since control foremen should have the ability and authority to make changes in the field if necessary.

In a closely related talk, Robert N. Marcum, manager of plant services, Hughes Aircraft, Newport Beach, Calif., discussed planning of engineering and maintenance budgets, declaring that the subject includes an understanding of man-

ENGINEERING PANEL discusses highlights of electrical facilities at Milan's Restaurant, Chicago's first "Gold Medallion" restaurant. Answering questions of architects and engineers at preview are (L to R): Jack Pohl, commercial cooking specialist, Commonwealth Edison Co.; Dick Wagoner, district sales engineer, Carrier Corp., heat pump supplier; Ion Caloger, consulting engineer; and Bob Geyer, architect and engineer, Commonwealth Edison Company.

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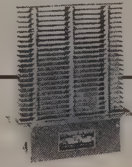

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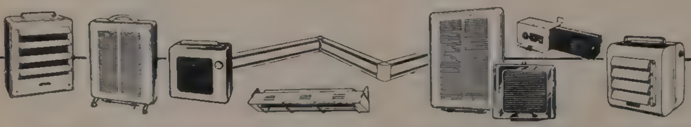

ACTION COMMITTEE for the 1961 Electrical Maintenance Conference included (left to right, rear row) Walter Collins and Lloyd Gates, Los Angeles Dept. of Water and Power; Paul Henrichs, Southern California Edison Co.; Bob Proctor, Larson-Hogue Elec.; also (front row) John Horsburgh, Kaiser Steel, and Bill Paluska, Albert C. Martin & Assoc.

power, space and cost controls as well as expenses and capital factors. Marcum stated that cost-control systems should be equated as running records of performance against budgets for controllable costs; should have a responsible signature authorization system; should provide for the monitoring of material requisitions; and should include weekly or monthly reports to all plant engineering supervisors concerning budget, dollar goals and dollar performance. Plants which will make profits in a competitive market are those which can accurately forecast required expenses, accurately perform against operating budgets, and take full advantage of available facilities, manpower and materials to obtain consistent profits, he stated.

Work Evaluation

Work sampling and work measurements were likewise explored by Donald L. Wheeler, director of industrial and plant engineering, Robertshaw-Fulton Controls, Long Beach, Calif., and by T. Blair Evans, deputy chief for industrial engineering, Wright-Patterson Air Force Base, Ohio.

After reviewing various methods for obtaining basic information relating to job evaluation, Wheeler concluded that maintenance is an indirect cost, and that indirect costs usually represent great potential savings in plant operation because traditionally they have been subjected to the least control. One reason for this is the tradition of individual craftsmanship; another reason being that much of the work is noncyclic and therefore never standardized. However, work sam-

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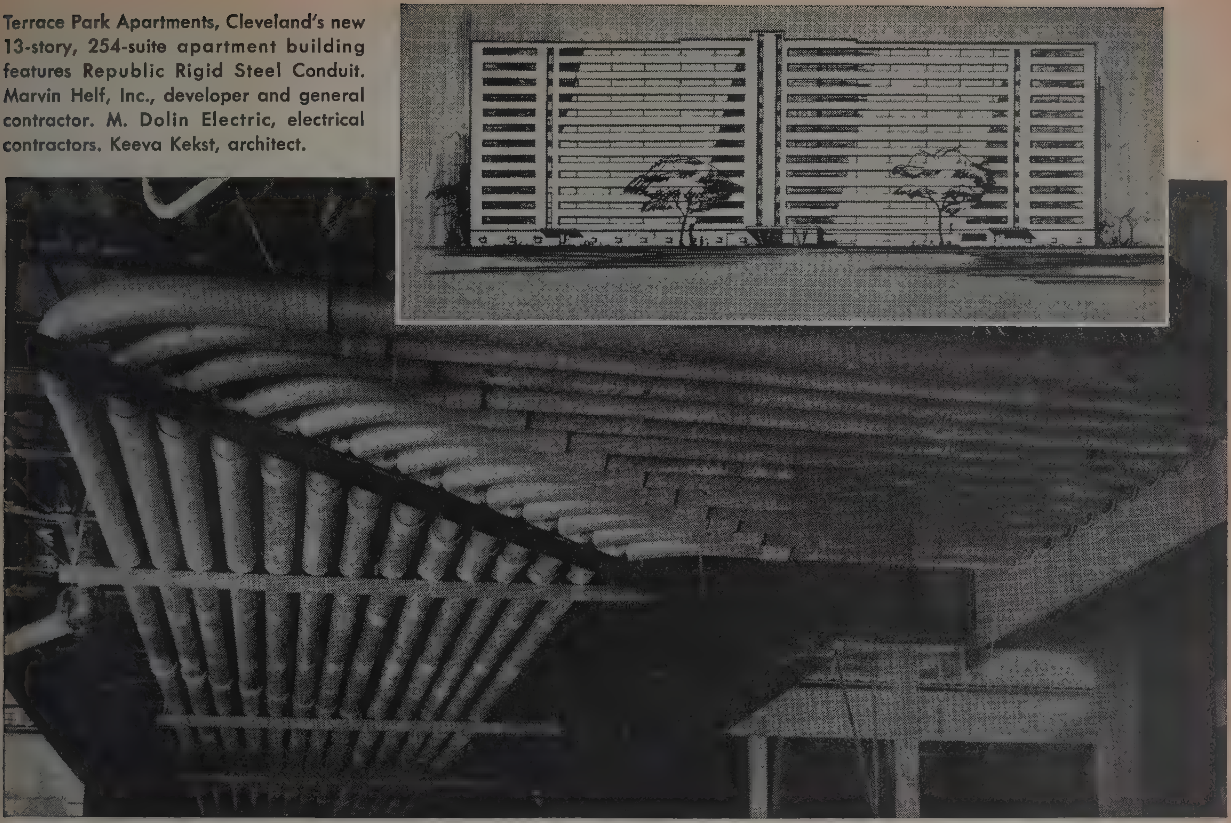
INDUSTRIAL PLANT maintenance was topic of discussion by panelists Frank S. Miller, plant engineer, Robertshaw-Fulton Controls; Dr. Henry Lee, technical director for The Epoxylite Corp.; Frank Pierce, electrical engineer with the Los Angeles Refinery of the Union Oil Co. of Calif.; Dick Pehl, maintenance superintendent for Kaiser Steel, and Robert Marcum, manager, Plant Services, Hughes Aircraft Co. Discussion took place at 7th conference of the Electrical Maintenance Engineers Association of Calif.

pling now provides a reliable tool for measuring various aspects of these relatively uncontrolled cost areas.

Evans maintained that control of manpower can only come from establishment of time standards for performing various jobs, because control is only possible when standards exist. Valid standards, however, should be consistent, accurate, attainable and acceptable, although non-repetitive jobs employing non-standard methods should not be included in this approach. Evans concluded with a note of caution; stating that whenever performance measurements are applied, workers generally are motivated towards producing more work with less actual hours of labor input, whereas maintenance men should be motivated towards the necessity for less work rather than more.

Indirect labor costs were also considered by Harry Monroe, general foreman of maintenance, North American Aviation's Rocketdyne Div., Canoga Park, Calif. Monroe contended that the ability to secure competitive business in fields where a few cents per unit may be the difference between successful or unsuccessful bidding requires that intelligent management keep changing conditions under constant surveillance. Money can be saved simply by not spending, he said, but work must be performed if products are to be produced, and work involves costs, many of which, such as maintenance, are indirect and therefore difficult to define or control. Reduction of indirect costs

Terrace Park Apartments, Cleveland's new 13-story, 254-suite apartment building features Republic Rigid Steel Conduit. Marvin Helf, Inc., developer and general contractor. M. Dolin Electric, electrical contractors. Keeva Kekst, architect.



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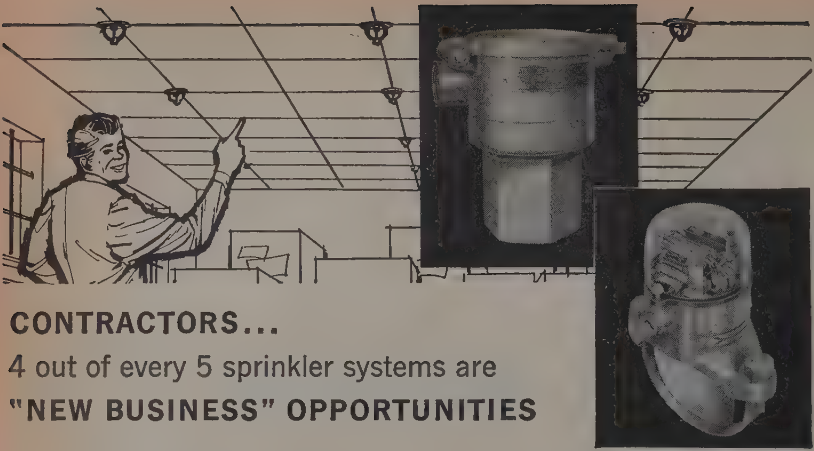

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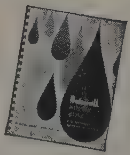

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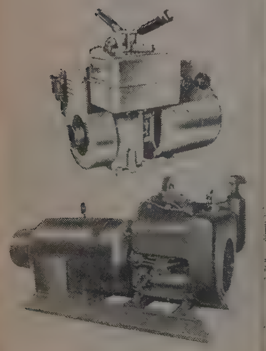

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A PRODUCTIVE CLIMATE for maintenance-management cooperation was subjected to critical consideration by EMEA conference speakers Floyd O. Nelson, head of Electric Dept., Rome Cable Div. of Alcoa; Regis Gubser, vice president in charge of engineering for Calif. Consumers Corp.; Bernard A. Shrive, electrical superintendent for Kaiser Steel, and Donald K. Higgins, special project engineer, American Potash & Chemical Corp.

are possible, however, by having a clear concept of budgets and available funds; knowing factors that can be controlled; analyzing actual requirements, classifying needs to determine minimum frequencies and eliminating work performed in excess of minimum requirements; establishing goals and responsibilities; determining levels of work accomplishment, then taking proper action by preparing supervisors through management development programs and stimulating competitive action through departmental ratings.

Basic questions concerning what management, engineering and maintenance departments want from each other were answered by B. J. Sturman, Jr., manager, Pacific coast region, Manufacturing and Repair Div., Westinghouse, Sunnyvale, Calif., and by W. J. Smith, section head, plant engineering, Goodyear Aircraft, Litchfield Park, Ariz. In this discussion, Sturman reminded delegates that American industry is facing a profit squeeze; that Commerce Department statistics indicate that national maintenance costs are now somewhere above $14-billion annually; that this represents 5% of the total sales dollar of companies represented by the statistics, and that it is estimated that over $4-billion is wasted needlessly due to inefficient maintenance operations.

Two decades ago there existed a 20-to-1 ratio between operating and maintenance personnel, he continued, whereas today the ratio is generally less than 10-to-1 and, in some industries, as low as 1-to-1; these figures indicating the growing importance of the entire maintenance concept. Sturman urged

Ernest R. Vick (left), Secretary-Treasurer, and Duane Lintecum (center), President, Vick-Lintecum General Contractors, Inc., North Kansas City, Mo., showing Don Bevan, their Dodge Representative, around one of their current jobs.

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The partners follow their Dodge Use-Plan carefully. They go through their Dodge Reports first thing every morning. They take note of jobs their firm can handle and screen them further to select the ones they'd like to bid on. "After we have submitted our bid, we wait for the Dodge Report that lists the three low bidders," they say. "Even if we're not among the three, the information is valuable, because we can compare our own bid and thus have excellent control of our own efficiency. Following Dodge Reports on work we do not bid gives us the benefit of keeping informed on all construction activity. And checking subcontractor lists helps us identify subs bidding for certain types of construction work."

Both partners agree that without Dodge Reports they would have to restrict their operations to an area within 35-miles of Kansas City instead of the large bi-state area they now effectively cover.

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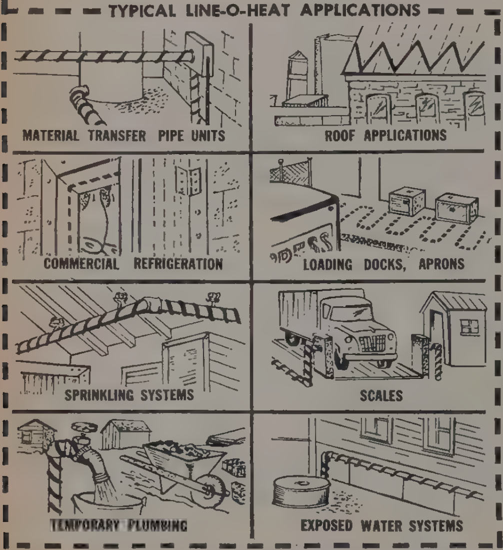

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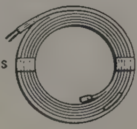

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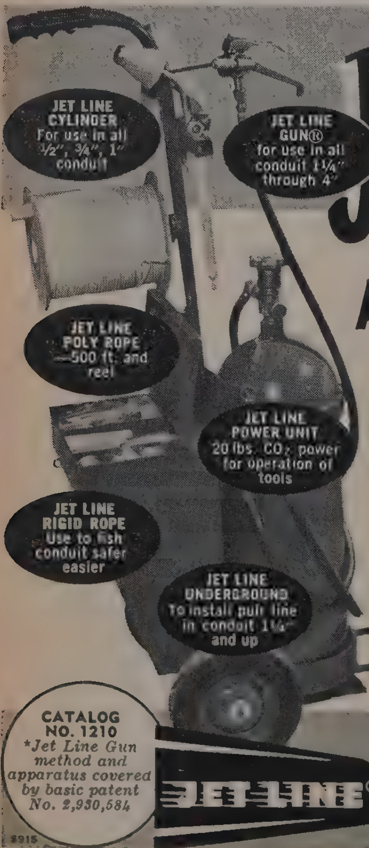
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PROGRAM CHAIRMAN C. D. Gibson checks platform facilities with Dr. Harry Helson, professor of psychology, University of Texas, prior to IES session on research contributions to lighting progress at regional meeting in Sacramento.

those in attendance to find consistent systems for assigning job priorities, determining accurate manpower and material requirements, maintaining safe working conditions, maintaining complete reference libraries of instruction manuals and drawings pertaining to equipment under their responsibility, and to seriously apply "make or buy" principles to maintenance; weighing costs of in-plant activities against maintenance through contracts with outside firms. Referring to growing know-how, new techniques and new products available, Sturman concluded by saying, "If you are doing your jobs as you did them a decade ago, chances are 10-to-1 you are doing them wrong," since today's competitive status dictates constant progress through change.

On the other side of this management-engineering table, Smith responded that plant engineering is a service organization and should justify its existence by providing the best service that management is willing to afford. However, if maintenance and engineering are to function economically and efficiently, it is imperative that management provide those departments with a voice in management, authority commensurate with responsibility, proper equipment, adequate manpower and money to do their work effectively. If any service group is not qualified, then it is the responsibility of management to initiate changes, he said. However, if management concedes that these departments are experts in their fields and are rendering valuable service, then their advice should be sought and heeded in those cases where the specific de-

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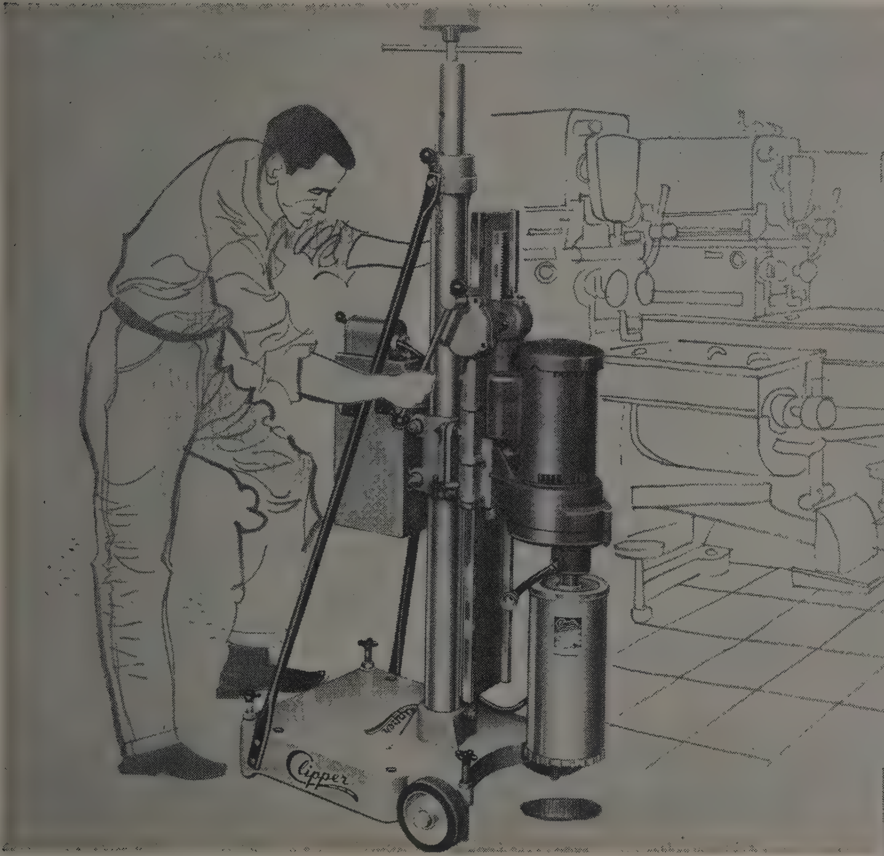

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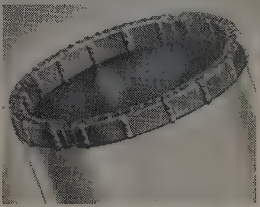

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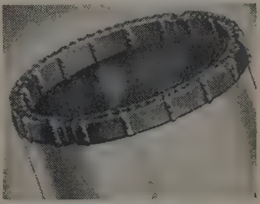

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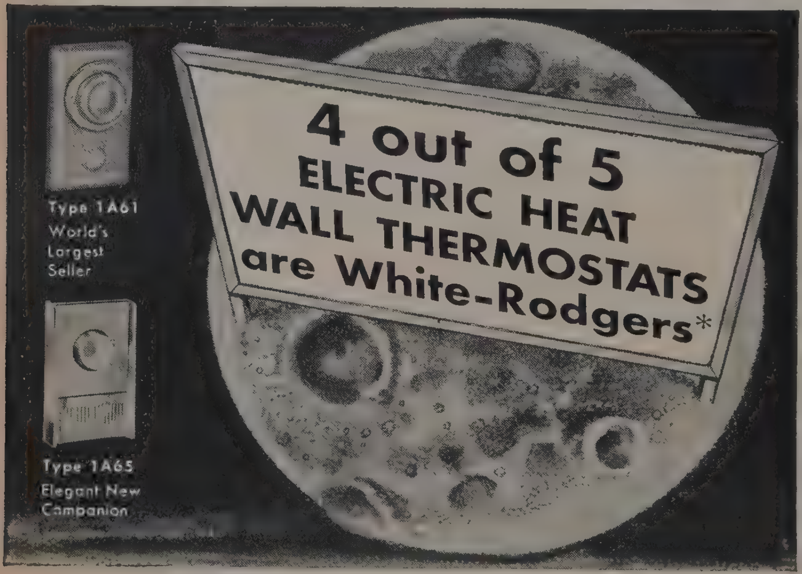

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partments are involved with subsequent operations.

How plant managements can get the most from their electric-power investments was the subject of a talk by Carroll M. Cole, rate application engineer, Dept. of Water and Power, Los Angeles, who discussed rate-making procedures, demands, load and power factors, fuel adjustments and other related charges. He also advised those present to seek advice from local utility consultants concerning most favorable rates, primary voltages, transformation and distribution methods.

Engineering and constructing plant facilities was a panel subject discussed by Henry D. Wood, plant engineer, Armco Steel, Los Nietos, and by J. F. Gardner, plant engineer for ground systems, Hughes Aircraft, Fullerton, both of California. In this discussion, Wood declared that planning and construction work alike involves continuous evaluation from technical, human and financial viewpoints, and that when engineers are given assignments for projects, they should be acutely aware of those interested in the project; what decisions already have been made by whom; to what extent those decisions can be revised; and whether the work is to be performed by their own crews or by outside contractors. Wood also mentioned that management rarely is interested in, or capable of appreciating, all engineering details. Therefore key construction plans should be simplified for their benefit, including furniture and equipment layouts in template form to provide scale, and including cranes, lighting, ventilating and air conditioning, power equipment and distribution symbols for basic understanding. Many people cannot visualize a completed project from plans and specifications, he said, so it is the responsibility of engineers to prevent any misunderstandings.

Gardner maintained that persons responsible for planning any engineering action should assemble all pertinent information, evaluate it as to validity, determine what methods and alternates are feasible to attain the objectives, then recommend courses of action. He also urged management to be specific in their directions, concluding with the statement that "As-good-as-possible does not provide adequate quality control; as-soon-as-possible is not a schedule, and as-cheap-as-possible is not a method of cost control."

These various discussions were presented in a series of ten sessions

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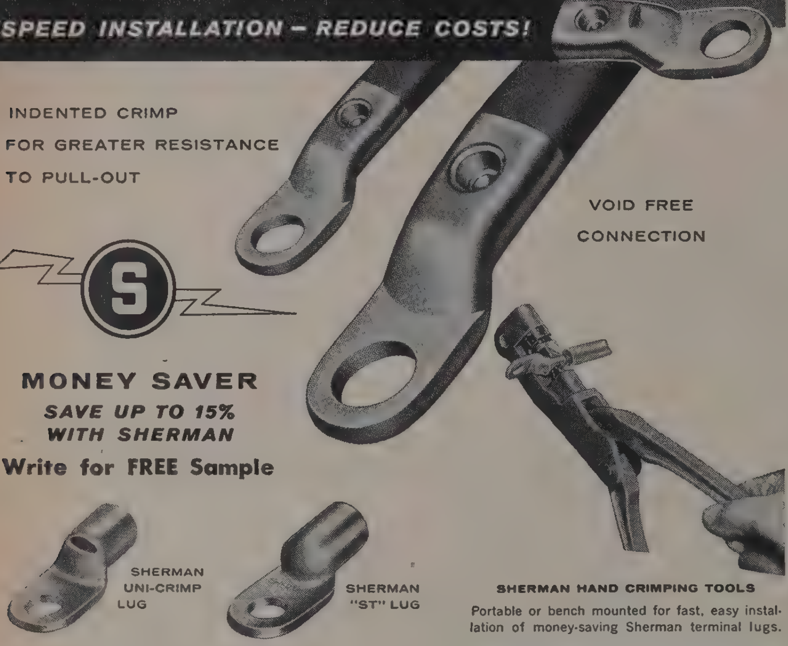

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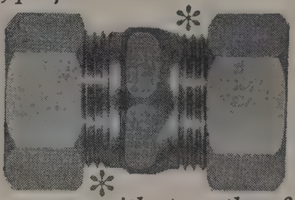

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Where the new ideas come from

during the 2-day conference; sessions being variously chairmanned by L. C. Morrow; E. M. Goodbar, maintenance superintendent, Columbia-Geneva Steel, Pittsburgh, Calif.; T. E. Thal, plant project engineer, McCulloch Corp., Los Angeles; W. F. Faith, managing director, Air Pollution Foundation, San Marino, Calif.; James M. Weeks, plant engineer, Proto Tool Co., Los Angeles; John P. La Forge, engineer, Mobil Oil, Los Angeles; H. J. McKeever, manager, apparatus service shop, General Electric, Philadelphia; B. P. La Forge, plant engineer, Consolidated Electrodynamics, Pasadena; J. J. Frederickson, superintendent, maintenance and construction, Tidewater Oil, Martinez, Calif.; and W. E. Fore, plant engineer, North American Aviation, Los Angeles.

Over-all objectives of this conference for management and maintenance executives were summarized succinctly by R. L. Saling, chairman of the conference and show Board of Sponsors and regional manager of maintenance products for Westinghouse, who pointed out that "America's high standard of living offers an inherent competitive advantage to foreign companies where workers are paid lower wages, and this advantage can be overcome only by our increased technical efficiencies and improved maintenance techniques which, in turn, can benefit from an interchange of practical ideas from responsible authorities attending meetings such as this."

National Electrical Week

"Electricity Powers Progress" will be the theme of the 1962 observance of National Electrical Week, which is scheduled for February 11-17. The announcement was made by Harold A. Webster, president of the National Electrical Contractors Association and chairman of the National Electrical Week Committee, following a meeting of the full committee.

Mr. Webster and the three officers who served to head the 1961 NEW Committee were all re-elected for the 1962 Committee at the same meeting. They are: T. O. McQuiston, vice president, Metropolitan Edison Company, who was re-elected vice-chairman, A. W. Hooper, executive director, National Association of Electrical Distributors, re-elected secretary; and L. W.

HAROLD A. WEBSTER is chairman of National Electrical Week, which will be held February 11-17, 1962.

O'Brien, relations services, General Electric Company, re-elected treasurer.

In announcing the theme, Mr. Webster said: "The electrical industry intends to concentrate its efforts during the next National Electrical Week on informing our nation of the vital role electricity plays in our economy, our national defense, and our determination as a nation to improve our standard of living.

"The size of our country's electrical industry, electrical output and consumption made up one of the most significant yardsticks of our progress," he continued. "More and more ways are being found to put electricity to work for us—in science, industry, research, on farms and in the home. Electricity, possibly more than any other source of energy, is responsible for the high standard of living we now enjoy and for the great advances destined to take place in this decade.

"It staggers the imagination to envision our life without electricity," Mr. Webster said. "It is the lifeblood of our day-to-day living and the unlimited source of energy for tomorrow's advances. The NEW Committee believes that the theme 'Electricity Powers Progress' will help to drive home to all Americans —those in the electrical industry and the public at large—the importance and need for continuing growth of this giant force and industry, which contributes billions of dollars annually to the national economy."

For the 1962 observance of NEW, the Committee will again distribute planning guides and ma-

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The "SCOTCH" Brand Electrical Tape No. 33 used to wrap this splice, protects it against sun, wind, rain, sleet, and other adverse weather conditions. Easily applied, it provides a dependable insulation cover that lasts for years . . . costs only a few cents. When tape costs so little, can you afford less than the best?

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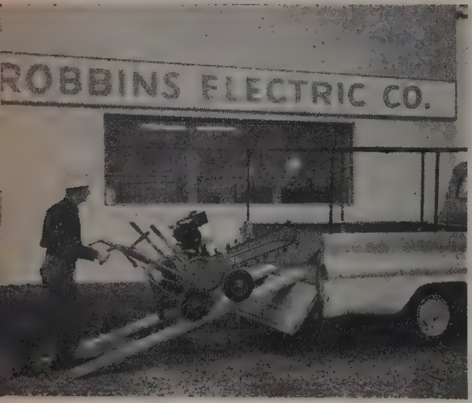

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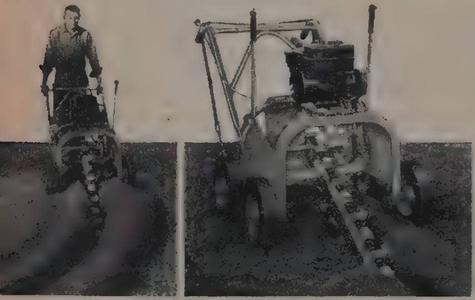

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terials for nationwide and local observances of the Week. Last February, NEW activities were carried on in more than 300 communities in this country and in Canada. It is anticipated that this number will be surpassed in 1962 as a result of the now firmly established recognition of NEW as an important activity by the various segments that make up the electrical industry.

National Electrical Week is sponsored by most of the industry's leading trade groups—manufacturers, contractors, distributors, utilities, leagues, labor, service and repair groups. The 1962 NEW Committee is made up of representatives from all of the sponsoring organizations.

Common Trench for Underground Cables

The first field trials in the U. S. of power and telephone cables installed with random separation in a common trench will soon be under way in the Chicago area. Authority to do this on a limited basis was granted to Commonwealth Edison Company and Illinois Bell Telephone Company by the Illinois Commerce Commission, July 25, 1961. This followed a petition of the two companies documented with experiences with joint burial construction and results of extensive EEI-Bell Lab tests conducted last year. Limitations restrict installations to primary service at 7.2/12.4 kv or less for 10,000 homes in not more than 100 projects between now and June 1963.

Under the new order, the requirement of at least a 12-in. earth separation between power and telephone cables (in the same or separate trenches) will be waived. Cables may be installed with random separation at the same level in a common trench. This, the order states, can reduce trenching and backfilling costs by about 25% and should stimulate the use of buried cable construction.

Engineering recommendations for the new installations include the following:

1. Power and telephone cables may be installed at the same depth with random separation in a common trench even though there will be no separation at some points. However, separations obtainable without cost penalty are desirable.

2. The underground portion of the power distribution circuit should be protected by a device ca-

pable of clearing line-to-ground faults in 12 cycles or less.

3. A bare neutral should be installed either as a separate conductor in close proximity to the primary cable or as metallic sheath or concentric conductors over the outside of the cable.

4. All existing grounds should be interconnected at each transformer location. These include primary and secondary neutrals, power cable shield or sheath, and telephone cable sheath.

5. Common grounding of secondary neutral, telephone protector and shield of telephone service cable should be made at each service entrance in conformance with NEC requirements.

6. The metallic sheath of the telephone cable is to be bonded to the power system grounded neutral at intervals of not more than 1000 ft.

Based on past experience with the types of cables to be used and the results of tests mentioned, the petitioners consider negligible the risk of personal injury or property damage which might result from random separation of the two cables in a common trench. Since the telephone cable is to be sheathed and grounded, inductive interference is not anticipated.

Electrical characteristics of the cables to be used are listed as follows:

For 7.2 kv the cable shall consist of a No. 4, 19-strand tinned or alloy coated copper conductor, strand shielded with a 19/64-in. wall of ozone-resistant butyl-rubber insulation, a 30-mil thick semi-conducting bedding or jacket over the insulation, and a covering of 12 No. 14 tinned or alloy coated uninsulated soft-drawn copper wires wound spirally with equidistant spacing around the circumference of the cable with a lay of from 5 to 7 in.

UNDERGROUND DISTRIBUTION in Chicago area residential development feeds pad-mounted transformers like this. Secondary services to homes go underground.

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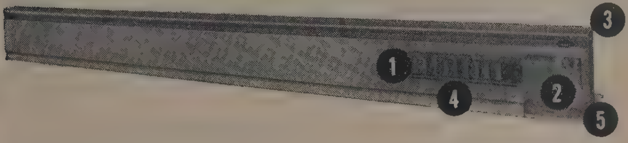

INSTALLATION IS EASY: (1) heating element requires no disassembly, (2) wiring connections are easily accessible *in front,* (3) all covers, end caps and corner pieces snap into place, (4) ample space along raceways for wiring and interconnecting heaters, and (5) sections are easily joined at either end.

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Here's a modern, comprehensive reference and instruction manual on the methods and techniques used in constructing systems for power, light, signals and communications. Covering the best practice on selecting, mounting, connecting and housing all types of electrical equipment, **this manual presents *1959 National Electrical Code data* relating to installation. And a wealth of special illustrations are used throughout to clarify fine code points.**

Chapters are broken down on the basis of types of equipment to facilitate ready reference: lighting equipment — motors and controllers — conductors — raceways — switches — overcurrent protective devices — switchboards and panelboards — transformers — capacitors and regulators — power sources — high voltage — signals and communications.

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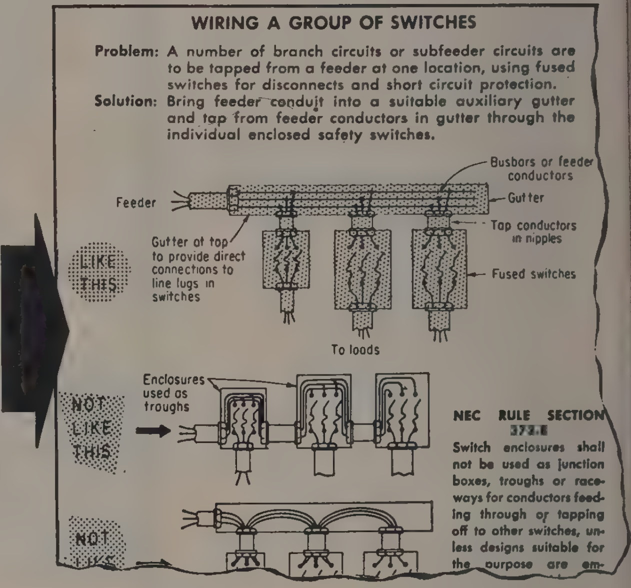

WIRING A GROUP OF SWITCHES

Problem: A number of branch circuits or subfeeder circuits are to be tapped from a feeder at one location, using fused switches for disconnects and short circuit protection.

Solution: Bring feeder conduit into a suitable auxiliary gutter and tap from feeder conductors in gutter through the individual enclosed safety switches.

Busbars or feeder conductors
Feeder
Gutter
Tap conductors in nipples
LIKE THIS
Gutter at top to provide direct connections to line lugs in switches
Fused switches
To loads
Enclosures used as troughs
NOT LIKE THIS
NOT LIKE

NEC RULE SECTION 373-8

Switch enclosures shall not be used as junction boxes, troughs or raceways for conductors feeding through or tapping off to other switches, unless designs suitable for the purpose are em-

PLANT ELECTRICAL PEOPLE — This book should be in the reference library of plant electrical engineers, electrical supervisors and electricians.

ELECTRICAL INSPECTORS — Here's a unique presentation of code rules in combination with specific installation details taken from modern practice. The correlation between code generalities and actual job specifics will assist inspectors in many difficult rulings.

CONTENTS

General Considerations
Luminaires and Lighting Equipment
Motors and Controllers
Conductors
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Switches
Overcurrent Protective Devices
Switchboards and Panelboards
Transformers
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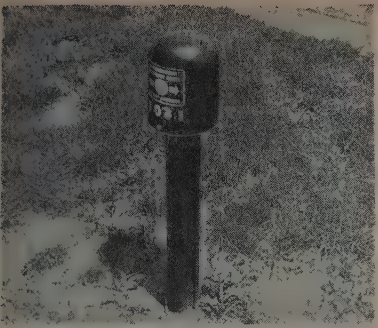


TELEPHONE PEDESTAL for underground telephone service in the same development is a number of feet away from the power cables. Under Illinois Commerce Commission trial installation order, power and telephone distribution cables will be in same trench without earth separation.

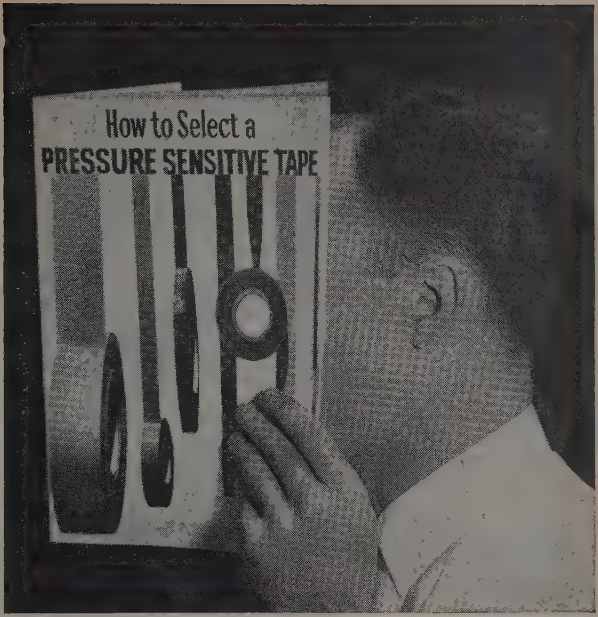
Or, the 7.2-kv cable can be a No. 4, 19-strand copper conductor, strand shielded, with a 14/64-in. wall of polyethylene insulation, a semi-conducting covering over the insulation, and a $\frac{5}{64}$-in. lead sheath overall.

The 2.4-kv cable shall consist of No. 4, 19-strand aluminum conductor, with 10/64-in. insulation of ozone-resisting butyl rubber, jacketed with $\frac{3}{64}$ in. of non-conducting heavy-duty black neoprene and a covering of seven No. 14 tinned or alloy coated soft or annealed copper wires wound spirally with equidistant spacing around the circumference of the cable with a lay of from 4 to 5 in.

The telephone cable shall consist of a core of fine gauge (No. 19 to No. 26) copper wires, the number of pairs to vary with service requirements. Individual wires will be insulated with an extruded layer of polyethylene. The entire core will be wrapped with Mylar or Polypropylene. The wrapped core will be further sheathed in an 8-mil aluminum envelope and an outer 65-mil jacket of extruded polyethylene.

Under terms of the Commission order (limited exemption to Section 9 of General Order 160) and pursuant authority, neither petitioner is permitted to dig up a cable, if a fault should occur, unless a representative of the other is present. The only exception to this requirement, scheduled to end Jan. 1, 1964, is an emergency requiring immediate action.

Commonwealth Edison Company and the Illinois Bell Telephone Company, now plan to approach a number of home builders in the Chicago metropolitan area to secure their cooperation in the authorized field trials.



Free booklet tells you what to look for in a pressure-sensitive tape

Here's a handy, new booklet that gives clear, concise answers to nearly any pressure-sensitive tape problem. It's based on Johns-Manville's long years of experience in the manufacture of tapes for electrical and industrial applications. It's called "How To Select A Pressure-Sensitive Tape," and tells you how to effect important economies; help speed production; eliminate knotty mechanical difficulties. It tells:

- Why the adhesive qualities of a tape are as important as the backing material.
- What causes tape failure; and how to prevent it.
- A glossary of terms associated with pressure-sensitive tapes.
- A complete list of authoritative technical data files available.

JOHNS-MANVILLE JM JOHNS-MANVILLE PRODUCTS
DUTCH BRAND® TAPES
BOX 14, NEW YORK 16, N. Y.

Please send me a free copy of "How To Select A Pressure-Sensitive Tape."

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G&W **CABLE NIGHTCAPS**

Seal Unfinished Cable Joints Against Moisture And Dirt

Cable splicing no longer need be one continuous operation when G&W Cable Nightcaps are used. Unfinished cable joints or terminations can be left overnight or for several days at a time with complete assurance that work will remain dry and clean as when sealed.

The G&W Cable Nightcap consists of a heavy plastic sleeve, waterproof paper to keep the plastic clean, tape, desiccant, and humidity indicator. The sleeve is slipped over the unfinished joint and one end taped tightly to the cable. Desiccant and humidity indicator are then inserted into the sleeve and its remaining end taped to the cable on other side of the joint. Waterproof paper is laid over the sleeve for protection.

Further information on the Cable Nightcap is available from G&W Electric Specialty Company or consult your local G&W representative.

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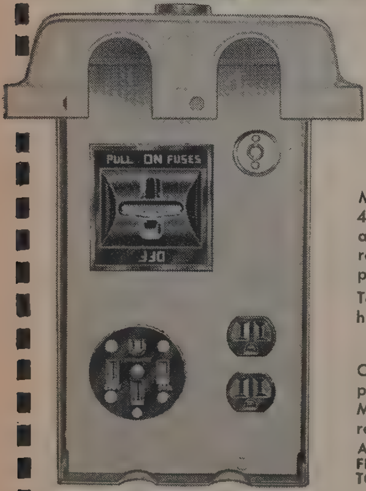
G&W ELECTRIC SPECIALTY COMPANY
3514 WEST 127th STREET • BLUE ISLAND, ILLINOIS
CANADIAN MFR. • POWERLITE DEVICES, LTD.
TORONTO, MONTREAL & VANCOUVER

Superior quality standards—inspired specialized design J61-1

Midwest COMPLETELY WEATHERPROOF **U-L APPROVED**

POWER OUTLETS



CHOICE OF FUSED OR CIRCUIT BREAKER TYPES

FOR FARMS, RANCHES, MOBILE HOME PARKS, INDUSTRY, OUTDOOR CONSTRUCTION!

MODEL P-55-F, as illustrated, has a 50 amp, 250 volt, 4 wire power receptacle, protected with a 2 pole, 60 amp pull out block. Also has a grounded type duplex receptacle protected with a separate fuse. U-L Approved!

Top hub and three KO's in bottom facilitate overhead or underground connections.

COMPLETELY TAMPERPROOF!

Cover closes completely when in use and can be padlocked to eliminate tampering. Also Circuit Breaker Model similar to model illustrated, with circuit breaker replacing the fuses.

A COMPLETE LINE OF STANDARD MODELS TO CHOOSE FROM IN FUSED OR CIRCUIT BREAKER TYPES WITH 15 TO 60 AMP, 3 and 4 WIRE RECEPTACLES.

OVER 100 DIFFERENT MODELS!

SEE YOUR LOCAL ELECTRICAL DISTRIBUTOR OR WRITE . . .

Midwest ELECTRIC PRODUCTS, INC. DEPT. EC
MANKATO, MINNESOTA

CHECKING ELECTRICAL PLANS for large Portland, Ore., department store are Ed Kozlowski, foreman, and Al Appleton, coordinator for W. R. Grasle, the electrical contractor and engineer in a 5-level 7-acre project. Picture above was snapped in trailer office parked on the jobsite.

EASA News

Four EASA chapters—Great Lakes, Western Michigan, Central Ohio and Greater Cleveland—met in Toledo on August 21 for a day of golfing and a round of business and social activities. Bud Romanoff, Ontario Equipment Co. and Dick Romanoff, Romanoff Electric Co., both of Toledo, were hosts.

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A round of chapter meetings is scheduled for fall after a summer hiatus. Some of the larger meetings include:

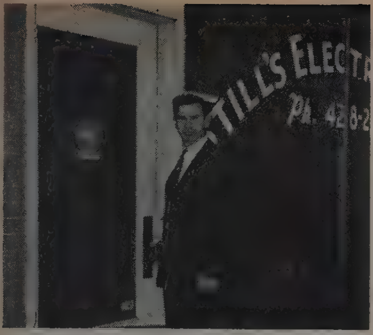
- Heart of American Chapter, at Mickey Mantle's Holiday Inn, Joplin, Mo., September 13-14;
- Southwestern Chapter, at Kingston, Okla., October 5-7;
- Southeastern Chapter, at Dinkler Plaza Hotel, Atlanta, Ga., November 2-4.

• • • •

The first meeting of the 1962 convention committee was held in Chicago at Como Inn on July 26. More than 25 members attended along with the new EASA executive vice president August A. Baechle. The convention will be held in Chicago at the Conrad Hilton Hotel, June 10-13, 1962.

Paul Sievert, of Sievert Electric Co., and Robert Kaska, of Chicago Electric Co., both of Chicago, were named co-general chairmen of the 1962 convention. Assisting them will be Sigmund Pluskota, Pluskota Electric Co., Chicago, president of the Central District Chapter of EASA, and the following committees:

Program Committee—Joseph Ferrari, Excel Electric Co., Chicago, chairman; and Bill Kaska, Chicago Electric Co., Chicago, and



OWNER JERRY STILL of Still Electric Co., Decatur, Ill., poses before the new EASA emblem on his shop door. Mr. Still opened his own business in 1958, started training vocationally handicapped persons in electrical apparatus service a year later as part of a unique program conducted by the State of Illinois.

Hans Westphal, Westphal & Co., Janesville, Wis.

Entertainment Committee—William Luebker, Hyre Electric Co., Chicago, chairman.

Exhibit Committee—Abe Marcus, Ther Electric & Machine Co., Chicago, chairman; Arthur Wagner Sr., Wagner Electric Co., Chicago.

Publicity Committee—Abe Marcus, Ther Electric & Machine Co., Chicago.

Reception Committee—Ted Hankins, Condo Electric Co., Chicago, and Fred Westphal, Westphal & Co., Chicago, co-chairman.

Transportation Committee—Alex Pawlicki, Hygrade Electric Co., Chicago, chairman.

Registration Committee—Glenn Glave, Chicago Electric Co., Chicago, chairman.

Other members of the general convention committee include Jack Lessel, Central Motor & Repair Co., Chicago; and Elmer Jandt, C&H Electric Co., Chicago.

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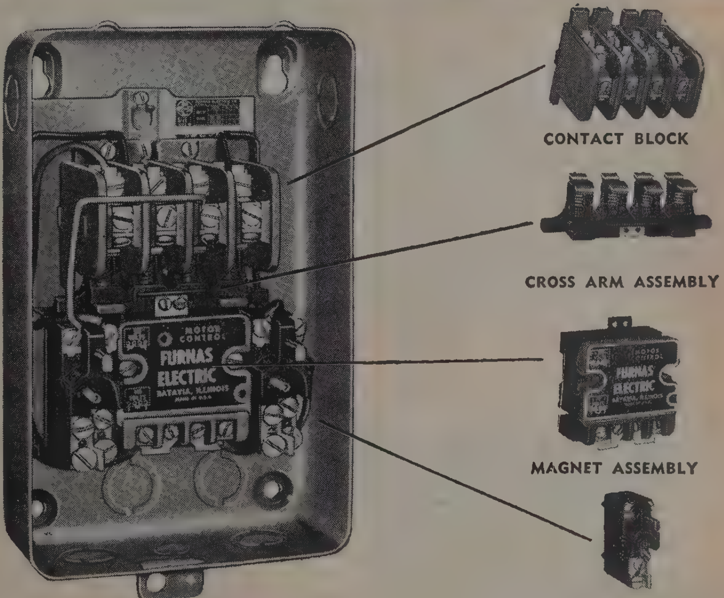
A West Coast Regional Conference of EASA has been called for September 22-23 at Charterhouse Hotel, Anaheim, Calif., opposite Disneyland, it has been announced by H. O. Stump, Stump Electric Co., Los Angeles, president. Discussions will center around shop and office management.

• • • •

New officers have been named by EASA chapters. Among them—

Julian Hupp, Electric Motors Co., Cedar Rapids, Iowa, has been elected president of the Midwestern Chapter, along with Curt Flohr, Flohr Electric Co., Omaha, Neb., vice president; Elroy Reese, Reese Electric Co., Ames, Iowa, secretary-treasurer; and Glenn Smith, Elec-



TOP PERFORMANCE!

The highest quality means the best control! Furnas Electric components, with their "years ahead" design and top quality materials, assure you of top performance and longer control life.

CONTACT BLOCK—non-tracking, fungus and moisture-resistant. Made of impact-resistant material to withstand severe usage. Deep arc chambers prevent arcing.

CROSS ARM ASSEMBLY—of high-impact material for millions of operations. Stainless steel contact springs. Visible and front removable silver-cadmium oxide contacts.

MAGNET ASSEMBLY—dual voltage—dual frequency coils, 110-220 or 220-440 volts. Magnet features just one moving part. Layer wound encapsulated coil with built-in terminal board. Coils are built to withstand moisture, fungus and combustion.

TRULY TRIP-FREE THERMAL OVERLOAD RELAY——manual or automatic reset. Non-adjustable trip assures tamper-proof operation. Third overload kit can be added in the field.

A106

FURNAS

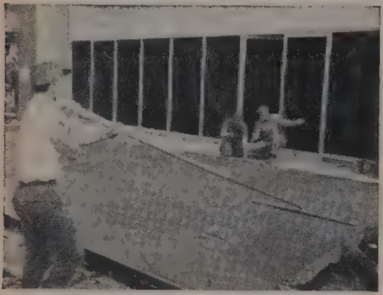
Write today for Bulletin 14-B1—
1067 McKee Street, Batavia, Illinois

FURNAS ELECTRIC COMPANY
BATAVIA • ILLINOIS

Sales Representatives in All Principal Cities

Pre-assembled, electrical
Sno-Melter speeds
South Bend sidewalk job!

As concrete crews poured and spread, electricians quickly rolled out 4½′ x 12′ Sno-Melter mats* right behind them.



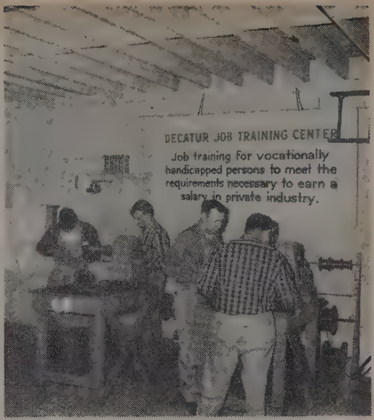
While concrete sections were leveled, well-tagged Sno-Melter lead wires were fed into pre-arranged junction boxes.

Electricians were well out of the way by the time top 1½″ layer of concrete was poured. No wonder job went so fast!

Next winter, no more snow to shovel! Pre-assembled electrical Sno-Melters assured a fast, trouble-free job on this walk in front of the new offices of Albert McGann Securities Co., South Bend, Ind. Sno-Melters *roll right out as concrete is poured* for walks, drives, ramps, docks. Write for engineering data and catalog.

*Special Sizes

EASY-HEAT INC.
"Electric Snow Removal Equipment"
Dept. ECM, New Carlisle, Indiana


DECATUR JOB TRAINING CENTER
Job training for vocationally handicapped persons to meet the requirements necessary to earn a salary in private industry.

TRAINEES at Still Electric Co., Decatur, Ill., learn to work with conventional shop tools as part of rehabilitation program for the vocationally handicapped, which the shop is conducting for the State of Illinois. More than 20 trainees, who have completed the intensive 75-week course, are now employed in industry throughout the country.

tric Machinery Service, Omaha, Neb., and Henry Peterson, Peterson Electric Motor Service, Mason City, Iowa, directors.

F. E. Cook has been elected president of Southeastern Chapter, along with Michael E. Assalone, vice president; James H. Parrish, secretary-treasurer; Mrs. Nancy S. Waldrop, executive secretary; and W. T. Becton, Roger W. Wilson, Ben F. Whaley, James R. Shearon, J. Lester Belcher and Lewis S. Bain, directors.

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The Mid-Year meeting of EASA's Board of Directors will be held in St. Louis at Clayton Inn, November 17-18.

New Books

ABC's of Computers (Cat. No. ABC-1), by Allan Lytel; 128 pages; $1.95. Technical Book Div., Howard W. Sams & Co., Inc., 2201 E. 46th St., Indianapolis 6, Ind.

Serves as a basic, self-teaching, introduction to computers in simple language for the technician, maintenance man or beginner. In logical progression, the book discusses circuits, tube and relay switching devices, and other components of both digital and analog computers.

How to Repair Small Appliances (Cat. No. APP-1), by Jack Darr; 128 pages; $2.50. Technical Book Div., Howard W. Sams & Co., 2201 E. 46th St., Indianapolis 6, Ind.

Discussed and pictured are the operation and repair of such ap-

PORTABLE Sky Witch HYDRAULIC

WORK
LOAD
LIFT
6 Models + Options

Lifts Men and Materials to Working Height . . . FAST!
Work height is easily changed up or down by a touch of the hydraulic controls, after releasing the safety lock. The big Sky Witch lifts loads of up to 2000 pounds and extends to heights of up to 30 feet—and there are models to fit other requirements! Ideal for installing and servicing overhead electrical systems! Offered in your choice of power, mounting, and optional features!

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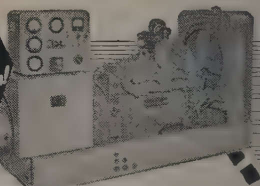
626 Birch St. • Perry, Okla. • FE 6-4404

LOW COST Protection!



KATOLIGHT
STANDBY POWER
Gasoline, Gas Diesel Models to 750 KVA
We all agree it is good business to insure against unforeseen losses due to fire, wind or accident . . . but none is available to cover loss of time, inconvenience, discomfort, dangers that power failures bring. With Katolight Power Plants you can keep your electrical equipment functioning until power is restored.

SPEEDS WORK! Low Cost!

KATOLIGHT
PORTABLE POWER
AVAILABLE ON DOLLIES OR TRAILERS
Crews have "plug-in" power at their finger tips when and where they want it. Quick, steady power for operating electric saws, grinders, drills, hammers, heaters, sanders, paint sprayers. No delays . . . No nuisance power line hook-ups. 500 to 35,000 watts and up.
BIGGER OVERLOAD CAPACITY
WRITE FOR NEW BROCHURE!
Katolight CORPORATION
Box 891-53 Mankato, Minnesota

pliances as toasters, shavers, irons, electric blankets, knife sharpeners, mixers, blenders, coffee makers, popcorn poppers, electric skillets, heating pads, fans, can openers and rotisseries, with chapters on broken or worn line cords, plugs and attachments, and defective heating elements and thermostats.

Tube Substitution Handbook, Vol. 2 (Cat. No. TUB-2); 96 pages; $1.50. Technical Book Div., Howard W. Sams & Co., Inc., 2201 E. 46th St., Indianapolis 6, Ind.

Up-to-date listing of substitutions possible in electrical equipment employing electronic tubes, including cross-referenced sections of both American and European tubes.

American Standards Publications available from American Standards Assn., 10 E. 40th St., New York 16, N. Y.:

IEC Publication 71: Recommendations for Insulation Coordination ($3.20).

IEC Publication 51: Recommendations for Indicating Electrical Measuring Instruments and Their Accessories ($6.00).

IEC Publication 117-2: Recommended Graphical Symbols (for machines, transformers, primary cells and batteries) ($2.40).

C 80.5-1960: American Standard Specifications for Rigid Aluminum Conduit (50¢).

Films

Meter Testing Made Safe. 16-minute, 35mm sound-slide film in color presents safety practices for use when testing meters where test switches and test blocks are used. $35 per set. Edison Electric Institute, 750 Third Ave., New York 17, N. Y.

Electric House Heating. 18-minute, full-color sound film, 16mm, illustrates man's progress in bringing warmth into his home, showing consumers that electric heating is today's modern, effective way to obtain winter comfort. $55 per print, plus postage. Live Better Electrically Program, Edison Electric Institute, 750 Third Ave., New York 17, N. Y.

From a Bed of Pain (Lessons from a Near-Fatal Electric Shock Accident). 15-minute, 35mm sound-slide film in color portrays how and why an accident occurred to a lineman, with a discussion of basic precautions which would have prevented it. $35 per set. Edison Electric Institute, 750 Third Ave., New York 17, N. Y.

A SMALLER 200-AMP BREAKER—FITS IN HALF THE SPACE OF THE ONE YOU'RE USING. You can save several inches of panelboard space (and a number of dollars) by using Heinemann's SE-33 circuit breaker. It's only half the size of comparably-rated breakers — and costs even less than most equally-rated fused equipment. Other advantages are magnetic actuation (no troubles with high ambient temperatures) and pressure-type solderless connectors (for copper or aluminum conductors in sizes from #6 to #250, CM, CU/AL). A two-pole breaker, the SE-33 comes in standard ratings from 125 to 200 amps, 120/240V, AC. Also available in its own indoor or outdoor enclosure. Details are in Bulletin 1003. Write for a copy.

HEINEMANN ELECTRIC COMPANY, 132 BRUNSWICK PIKE, TRENTON 2, N.J.

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specify the service entrance switch with proven...

2. Operating Performance

Operating Performance is the second of three vital "musts" for Service Entrance switches. The first is Electro-Mechanical Strength, the third—Load Break Dependability.

The Pringle LOAD BREAK Switch for Service Entrance application was put through severe tests for reliability. Sample of Operating Performance: at 130% rated load, 44 separate opening and closing operations. Another: 50 successive operations of the switch at 150% rated load. (In both cases, the tests could have been continued indefinitely without damage to the switch!)

Send today for proof of Pringle's unmatched reliability. Just ask for Test Report Bulletin P-112.

Pringle ELECTRICAL MANUFACTURING COMPANY

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DATES AHEAD

5th Electrical World Electric Heating and Heat Pump Conference—Sheraton-Park Hotel, Washington, D. C., September 25-26.

International Association of Electrical Inspectors — Chapter Meetings — George Welman, New Orleans, La., September 26; **Southwestern Section**, Lafayette Hotel, Long Beach, Calif., September 18-21; **Western Section**, Biltmore Hotel, Oklahoma City, Okla., September 25-27; **Eastern Section**, Warwick Hotel, Philadelphia, Pa., October 9-11; **Southern Section**, Grove Park Inn, Asheville, N. C., October 16-18. **Western New York**, Buffalo, N. Y., October 25; **North Central Div.**, Texas, Fort Worth, Texas, November 3; **Nebraska**, Grand Island, Neb., November 6-7; **Southern California**, Glendale, Calif., November 8; **Canadian Section**, King Edward Hotel, Toronto, Ont. November 17-18. **Illinois**, Morrison Hotel, Chicago, Ill., February 1-2; **Joint Five Chapters**, Shreveport, La., April 27-28.

American Home Lighting Fixture Month—Sponsored by the American Home Lighting Institute, Chicago, Ill., September 1-30.

Industrial Electronics Symposium—Bradford Hotel, Boston, Mass., September 20-21.

Illuminating Engineering Society—National Technical Conference, Chase Park Plaza Hotel, St. Louis, Mo., September 24-29.

Third Virginia Biennial State-Wide Industrial Exposition—Victory Stadium, Roanoke, Va., September 27-30.

Florida Association of Electrical Contractors—Annual conference, Fort Harrison Hotel, Clearwater, Fla., September 29, 30—October 1.

Lighting Progress Exposition—Sponsored by the Electric League of Southern California, Hollywood Palladium, Los Angeles, Calif., October 3-5.

Delaware Valley Electrical Progress Show—Convention Hall, Philadelphia, Pa., October 3-5.

International Association of Electrical Leagues—25th Annual Conference, President Hotel, Atlantic City, N. J., October 4-6.

Western Building Industries Exposition—Great Western Exhibit Center, Los Angeles, Calif., October 7-10.

17th Annual National Electronics Conference — International Amphitheatre, Chicago, Ill., October 9-11.

National Electrical Contractors Association—Annual convention, Washington, D. C., October 10-14.

National Electrical Manufacturers Assn.—Annual meeting, Traymore Hotel, Atlantic City, N. J., November 13-17.

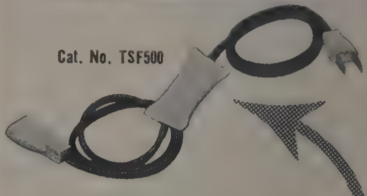
Electrical Engineering Exposition—Sponsored by AIEE, New York Coliseum, New York, N. Y., January 29-February 2, 1962.

National Electrical Week—National promotion, February 11-17.

Sixth National Electrical Industries Show — New York Coliseum, New York, N. Y., March 11-14.

Electrical Apparatus Service Association—Convention, Conrad-Hilton Hotel, Chicago, Ill., June 3-7.

Low Cost
FIXED TEMPERATURE
THERMOSTAT



FOR 120 and 240 VAC

Highly successful surface sensitive pre-set thermostat made of quality materials. U/L and CSA approved switch. Factory calibrated to operate above freezing. For automatic operation of any heating device up to 500 watts on 120 VAC or 1,000 watts on 240 VAC. Sealed waterproof. Has 4-ft. cord, plug and single outlet. Only $4.45.

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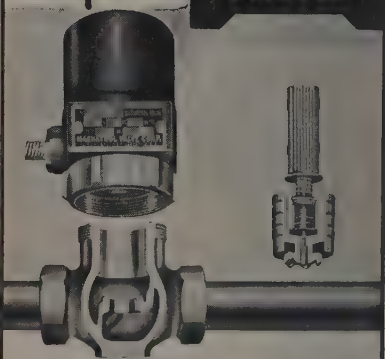
FARMINGTON, CONN.

Magnatrol SOLENOID VALVES



. . . ARE RUGGEDLY & ACCURATELY CONSTRUCTED TO GUARD AGAINST COSTLY FLOW FAILURES.

The entire operating mechanism of Magnatrol Solenoid Valves can be cleaned, repaired or replaced WITHOUT removing the valve body from the pipe line or breaking flexible electrical leads.

This unusual design advantage plus the fact that every Magnatrol Valve is CUSTOM ASSEMBLED and FACTORY TESTED . . . means greater dependability.

Available in normally closed and normally open models, in pipe sizes from 1/4" to 3". Pressure ranges from zero up to 500 psi.

Catalog mailed upon request.

Magnatrol VALVE CORP.
HAWTHORNE, 26
NEW JERSEY

Among the Manufacturers

Headquarters Announcements

General Electric Co., Schenectady, N. Y.—Ralph J. Cordiner, chairman of the board; Gerald L. Phillippe, president; Cramer W. LaPierre, executive vice president.

Pyramid Instrument Corp., Lynbrook, L. I., N. Y., has changed its name to **Amprobe Instrument Corp.**

Hysol Corp., Olean, N. Y., and **Permacel Div., Johnson & Johnson,** New Brunswick, N. J., jointly announce the sale of Permacel's epoxy electrical insulation potting and encapsulation product line to Hysol Corp.

Pennsylvania Transformer Div., McGraw-Edison Co., Canonsburg, Pa.—Fred H. Plank, president; succeeding W. E. Kerr, who was named chairman of Pennsylvania-Lectro Management Group; W. R. Swoish, vice president of marketing; and Walter H. Renberg, sales manager.

Federal Pacific Electric Co., Newark, N. J., has opened a manufacturing, warehousing and sales center in Des Plaines, Ill., with Clifford E. Harris as manager.

Multi-Amp Electronic Corp., has moved to its new location at 61 Myrtle St., Cranford, N. J.

Benjamin Div., Thomas Industries, Inc., Des Plaines, Ill.—Harry Shubart, director of manufacturing.

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Charles W. Parker, Jr., general marketing manager, New Products Dept.; Leonard J. Linde, director of engineering, Industries Group; Wayne A. Johnston, board of directors.

American Biltrite Rubber Co., Boston, Mass.—John M. Dennehy, product manager, electrical tape sales, Boston Woven Hose & Rubber Div.

General Electric Co., Tyler, Texas, has announced the formation of a new Product Section, the Central Air Conditioner Section, comprised of G-E's Tyler, Texas, Central Air Conditioner Plant and their Trenton, N. J., Furnace Plant, with W. J. McCullough as general manager.

Furnas Electric Co., Batavia, Ill.—James M. O'Rourke, sales manager.

International Resistance Co., Philadelphia, Pa.—J. Penn Rutherfoord, board of directors.

Arvin puts more P.E.P.
IN YOUR ELECTRIC HEATING BUSINESS!
It's happening across the country . . . greatly increased installations of America's most advanced electric heating line, preferred for more Performance • Ease of installation • Profit! Join the switch to Arvin and watch your sales start climbing!

INVISA-BASEBOARD . . . 4½" low, 1¾" thin, slimmest and thinnest of all! Radiant fins in Arvin's continuous rod-type element heat far faster. Installation is faster, too: pre-wired for connection ease; new "nail or screw" fastening; all without dismantling the unit! High or low wattage, various lengths, matching accessories.

PERFORMANCE! Greater customer satisfaction with proven, outstanding efficiency from exclusive designed heating elements.

INVISA-PANELS . . . nationally-featured ceiling heat units that completely eliminate the floor-and-wall problems in room planning! *Only 1³⁄₁₆" thin,* 24⅞" x 49½". Shipped completely assembled, they go up fast *anywhere* with simple "screwdriver-and-pliers" installation. No moving parts, trouble-free. Can be painted to match ceiling.

EASE OF INSTALLATION! Engineered into all Arvin units are special connecting advancements for far easier fastening, faster hookup to save you valuable installation time.

BUILT-IN WALL HEATERS . . . complete line of attractively-styled models, 120 and 240 volt, gives you a wide selection of 14 requirement-adaptations. Instant-heating elements, whisper-quiet fans and push-button controls. No oversize cutouts: each model fits easily between 16"-center studs, and features new-design rough-in box and quick-fastening clamps.

PROFIT! Arvin performance, consumer eye-appeal, time-saving installation plus good markup . . . all result in greater per-job profit with any Arvin units.

GET MORE FACTS NOW . . . write today for catalogs of Arvin's complete Electric Heat line including Ceiling Cable, Thermostats, Accessories.
GET FREE SPECIALIZED SERVICE . . . Arvin's Electric Heat specialists will work with you in every way, even to the outlining of an entire installation.
All Arvin units U. L. Approved.

Arvin® Electric Heat Division
ARVIN INDUSTRIES, INC., Columbus, Ind.

A LEADING NAME IN ELECTRIC HEAT PRODUCTS FOR 28 YEARS

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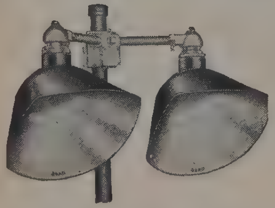
IS THE ONLY SOURCE FOR DOUBLE AND TRIPLE FLOODLIGHT UNITS . . . . .

ALL THREE UNITS

AVAILABLE IN



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RECTANGULAR
ROUND
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Porcelain Enamel Finish
Cast Aluminum Slip Fitters
and Wiring Hubs

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CHICAGO 7, ILLINOIS

Leece-Neville Co., Cleveland, Ohio—Harold J. Zuske, vice president and general manager, Fractional Horsepower Motor Div.; Albert D. Gilchrist, vice president and general manager, Alternator and Standard Products Div.; Robert G. Hill, general sales manager; William E. Carter, sales manager of original equipment; J. S. Allt, manager of all divisions.

Sylvania Electric Products Inc., New York, N. Y.—William F. Rueger, vice president and general counsel.

Anderson Electric Corp., Leeds, Ala.—John Q. Dickerson, field engineer.

Union Carbide Corp., New York, N. Y.—R. K. Turner, vice president.

Calcon Mfg. Co., Washington, Pa.—Arthur H. Lassers, general manager.

Worthington Corp., Harrison, N. J.—Draper E. Tessendorf, general manager, Mechanical Power Transmission Div., Oil City, Pa.; William A. Meiter, vice president of Washington, D. C., services.

Appleton Electric Co., Chicago, Ill.—W. P. White, Jr., executive vice president; Robert G. Ehret, director of purchases.

Minnesota Mining & Mfg. Co., St. Paul, Minn.—Dr. C. W. Walton, vice president for research.

Braden Winch, Div. of Nautec Corp., Broken Arrow, Okla.—R. L. Wilson, chief engineer.

Executone, Inc., Long Island City, N. Y.—E. Kenneth Marks, director of manufacturing.

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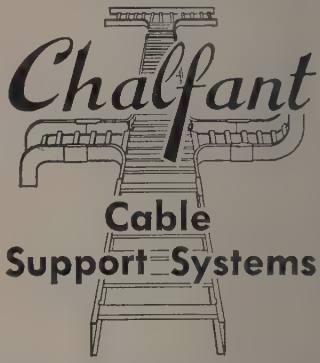

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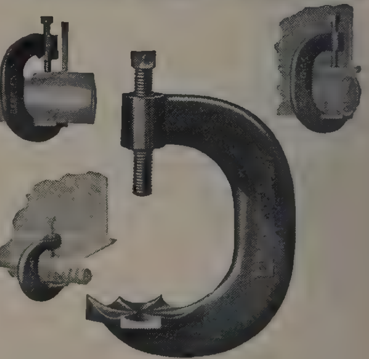

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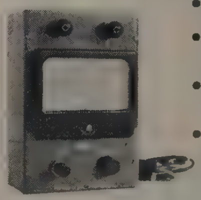

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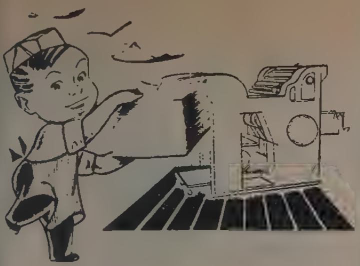

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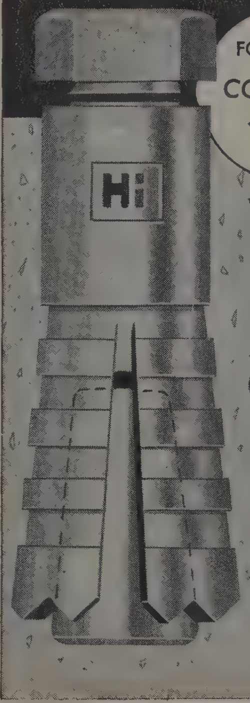

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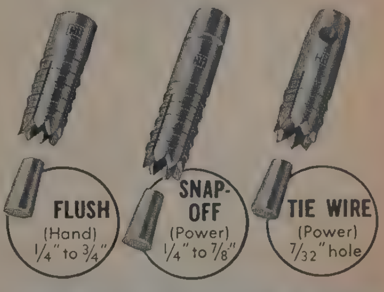

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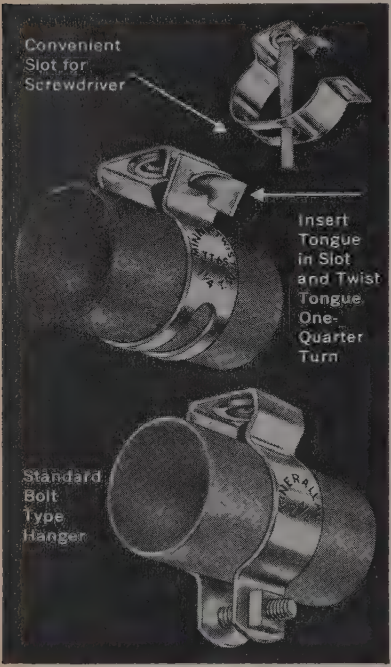
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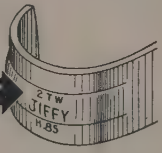

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ESTIMATING FORUM—XIV

[FROM PAGE 119]

job and this increases operating costs.

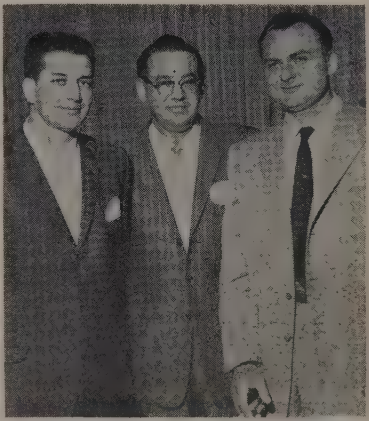
Extended Duration—Cost-Plus contracts, as a rule, run longer than fixed-price contracts of the same volume. This extra duration adds expense, much of which is not shown on the books. For a quick analysis, let's look at some typical cost figures.

Fig. 1 lists certain extended-duration costs for an $80,000 (including markup) contract of the 60/40 type (base cost: 60% material, 40% labor). Normal duration is five months. Extended duration would involve additional costs shown in the last two columns.

The first item in Fig. 1, for engineering (including field engineering), shows an extended-duration cost of $24 per month. At present salary levels, one trip to the job would cost that much.

According to "Electrical Estimating" (McGraw-Hill Book Co.), the manpower requirements of an $80,000 project would be an average of eight and a maximum of 12 men. This would range from 6,000 to 6,300 manhours (at $4.00 per hour). Tool investment would be around $2,400.

The estimated time that large



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RUGGED

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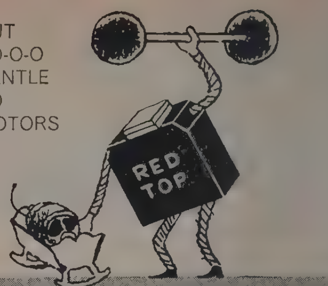

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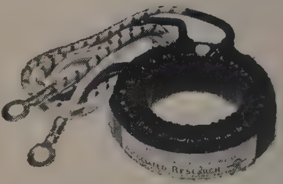

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[FROM PAGE 220]

tools can be available for actual use, during their rated life, is 58 months (see EC&M, December, 1956). Using 60 as a round figure, we have $2,400/60, or $40 per month.

In the example in Fig. 1, the extended-duration cost of tools is listed as $28.80 per month.

Cost of Billing—As we are not trying to establish any exact costs, billing details will not be covered here. However, it is important to emphasize that the expense of billing cost-plus projects must not be regarded lightly. It is doubtful whether many contractors have taken the time to study all of the costs involved.

Such costs can be kept at a minimum by billing a lump sum for so many hours of labor and a lump sum for material with jobbers' invoices attached. Detailed and billing of material items and labor hours can be expensive.

Contractor Opinions

Now comes a logical question: If Fixed-Price contracts are the better, why do contractors prefer Cost-Plus work? Some do not.

There are contractors who prefer a Fixed-Price contract whenever they have a choice. When dealing with regular customers, they usually give an upset price, use lump-sum billing, and give the customer the benefit of any savings that can be effected.

Other contractors feel it is to their advantage to promote and develop, among buyers, the habit of letting Cost-Plus contracts. This idea has merit. Buyers who favor the Cost-Plus arrangement are less likely to subject contractors to cutthroat competition.

Then there is a third group of contractors who, apparently lacking confidence in their estimates and ability to produce, want to play it safe by getting Cost-Plus work.

Fixed-Price contracts are a really fine part of our business. They are fascinating, keep us "on our toes," and make us do our best work. It is the high cost of estimating (getting one out of five jobs) and the cut-throat competition that makes fixed-price projects seem distasteful.

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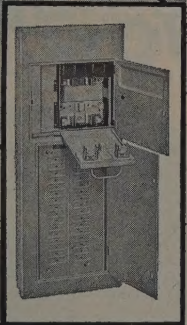

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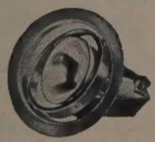

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PLANNING AN INDUSTRIAL ELECTRICAL SYSTEM

[FROM PAGE 99]

Study and actual installation results showed that the third proposal was most economical.

Installation Techniques

Considerable attention was given to installation methods and specially designed erection equipment, resulting in the following:

1. Use of modified roller hangers, complete with airplane messenger wire for side-tension control. Welded studs were used for securing roller hangers at 5-ft intervals.
2. Installation of roller hangers with a truck-mounted boom operated by pushbutton control. Two men can install a 510-ft roll of roller hangers and supports in 1½ hours.
3. Use of a pushbutton-controlled chain-operated conveyor type of hoist located at the center of the plant.
4. Use of index cards, to instruct the ground force for assembly of the whole system at ground level.
5. Preparation of fixtures, busways and boxes at ground level.

Our field supervisors closely followed these procedures, as shown in accompanying photos, and coordinated the lighting installation schedule with concrete floor work, step by step across the building. In this manner, the plant construction was successfully carried out through the winter and the job was completed ahead of schedule.

Approximately 100 loudspeakers are being installed for interplant paging. Time clocks and program controls are furnished for use with the paging system. Measuring noise levels in the existing plants aided in selecting the paging and program control system.

An ADT system and alarm signals have been installed to provide proper plant protection with minimum maintenance forces.

The construction of this new plant was supervised by the following Stone & Webster personnel: H. N. McCampbell, construction manager and vice president; C. K. Salbach, superintendent of construction; N. B. Cleveland, project engineer; and D. W. Nordbeck, building service engineer. Horacek-Hayden Inc., Rochester, N. Y., were the electrical contractors.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT • BUSINESS
EQUIPMENT — USED OR RESALE

OPPORTUNITIES

DISPLAYED RATE

EQUIPMENT & BUSINESS OPPORTUNITY advertising $21.00 per inch.

EMPLOYMENT OPPORTUNITIES—$28.10 per inch, subject to Agency Commission.

An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

UNDISPLAYED RATE

(Not available for equipment advertising) $2.10 a line, minimum 3 lines.

POSITIONS WANTED undisplayed rate is one-half of above rate, payable in advance.

Box Numbers—Count as one line.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Manufacturers Representatives Wanted

Nationally recognized manufacturer of complete line of plastic conduit for above and underground installations is seeking established manufacturers agents calling on the electrical distributor. Choice territories now available. Please write in detail to:

Mr. Nathan Pritcher, Vice President,
Consolidated Pipe Company of America,
1066 Home Avenue, Akron 10, Ohio

ADDRESS BOX NO. REPLIES TO: Box No.
Classified Adv. Div. of this publication.
Send to office nearest you.
NEW YORK 36: P. O. Box 12
CHICAGO 11: 645 N. Michigan Ave.
SAN FRANCISCO 11: 255 California St.

POSITIONS VACANT

Permanent openings for Resident Engineers experienced in supervision of construction of large steam power plants and/or high-voltage transmission lines. Degree and registration desirable. Excellent opportunity with consulting engineering firm. Please send resume of education and experience and salary requirements to P-7231, Electrical Construction & Maintenance.

Need man to take charge of Electrical Trade Association office. Labor relations major part of work. Travel consistently over state. Salary $7,500 to $8,500. Send resume to P.O. Box 8597, South Charleston, W. Va.

WIRE and CABLE WHEN YOU NEED IT

From Chicago you can get immediate delivery on all types of Electric Cable. Order today. We ship same day.
Send for our latest stock sheet
UNIVERSAL WIRE & CABLE COMPANY
2919 N. Paulina St. Chicago 13, Ill.
Branches: Los Angeles—Houston—Denver

Your Inquiries to Advertisers Will Have Special Value . . .

— for you — the advertiser — and the publisher, if you mention this publication. Advertisers value highly this evidence of the publication you read. Satisfied advertisers enable the publishers to secure more advertisers and—more advertisers mean more information and more products or better service —more value—to YOU.

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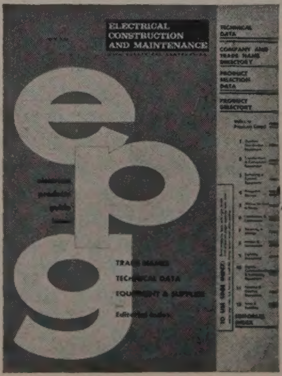
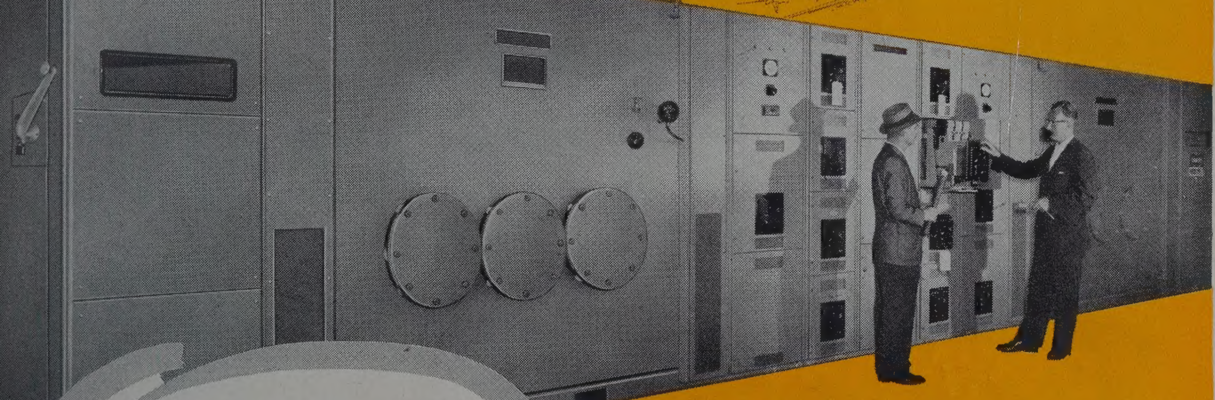


• These manufacturers advertised their products in the ELECTRICAL PRODUCTS GUIDE ISSUE

For more complete information, and application data on their lines, refer to the index of Advertisers in the ELECTRICAL PRODUCTS GUIDE . . . the 13th issue of ELECTRICAL CONSTRUCTION AND MAINTENANCE.

11 SQUARE D SUBSTATIONS SERVE COBO HALL...

World's largest exhibition building, COBO HALL occupies 10 acres of Detroit's Civic Center



...capable of supplying 22,000 KVA of continuous power!

Square D Field Engineer Don Selby *(right)* and Mr. Gil Brandt, COBO HALL Project Electrical Engineer of Giffles and Rossetti, architects and engineers, examining one of the drawout circuit breakers in the low voltage secondary portion of a Square D 2000 KVA double-ended unit substation equipped with nitrogen-filled transformers

Easy, fast installation was a prime objective when eleven Square D unit substations went into COBO HALL. The various sections of each substation were completely coordinated at the factory. Reconnection of those sections at the job site required a minimum of time and labor.

Design leadership is very much in evidence in Square D's broad line of unit substations. We suggest a three-point comparison to prove the point—ease of installation, minimum maintenance, maximum safety for both equipment and personnel.

AMONG OTHER SQUARE D EQUIPMENT IN COBO HALL

37 Motor Control Centers
28 Switchboards
550 Panelboards
100 Contactor Panels
1 Mag. Amp. Dimmer Board
10 Dimmer Panels
64 NEMA 4 Circuit Interrupters
120 Spotlight Control Panels
19,000 feet of Lay-In Duct

SQUARE D COMPANY

wherever electricity is distributed and controlled

NEW
Mark 9
LINE

CROUSE-HINDS
Copper-Free Aluminum
CONDULET®
CONDUIT FITTINGS

From Crouse-Hinds, originator and leading manufacturer of electrical conduit fittings, comes the new "Mark 9" line. Die-cast, copper-free aluminum. The ultimate in protection, and ease of installation. Compare with any other die-cast conduit fitting—and you'll choose no other.

Smooth and lightweight with the trim good looks that die-casting imparts.

More wiring room inside is provided by new cover-opening. Compare with others and see.

Rugged and corrosion-resistant because it's die-cast of copper-free aluminum, resistant to corrosion.

Easy to install, with self-retaining cover screws, smooth integral bushing, taper-tapped threads, longer grip-sure hubs.

Full range of types and sizes, from ½" to 4".

Complete selection of wiring devices.

Neoprene gaskets for greater resistance to oil and chemicals; with perforated tear-out centers where open gaskets are needed for wiring devices.

UL-listed; CSA-approved, made to Crouse-Hinds high standards of quality and inspection.

Competitively priced. Ask your Crouse-Hinds Distributor.

For complete "Mark 9" details, write for Bulletin #2730 or contact your Crouse-Hinds Office.

CROUSE HINDS
REG. U. S. PAT. OFF.

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